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Ladle and Casting Carriage Combined.

BY THOS. D. WEST.

The engravings seen are perspective and plan views of a carriage used in our foundry. Wishing to "kill two birds with one stone," I devised it so as to be safe for conveying large ladles of metal as well as heavy castings.

With the ladle set in the car, should anything break, it could not fall more than two inches, nor is there any danger of the ladle sliding or falling off the car. To see a heavy ladle full of fluid iron away up off the ground, does not inspire one with feelings of security or confidence, although it may be perfectly safe. Many shops that are obliged to truck their metal and castings have two cars—one for ladles and the other for castings. I think many of them would prefer to have one, could it be made to answer the purpose of both.

The construction of the car is very simple, and it costs but little labor to make. The car was cast "open sand;" the ladle box was formed with a dry sand core. The holes as *B*, *E*, *K* and *F* made a good bearing for the box core to rest upon. These holes were cast in for the purpose of lightening the casting.

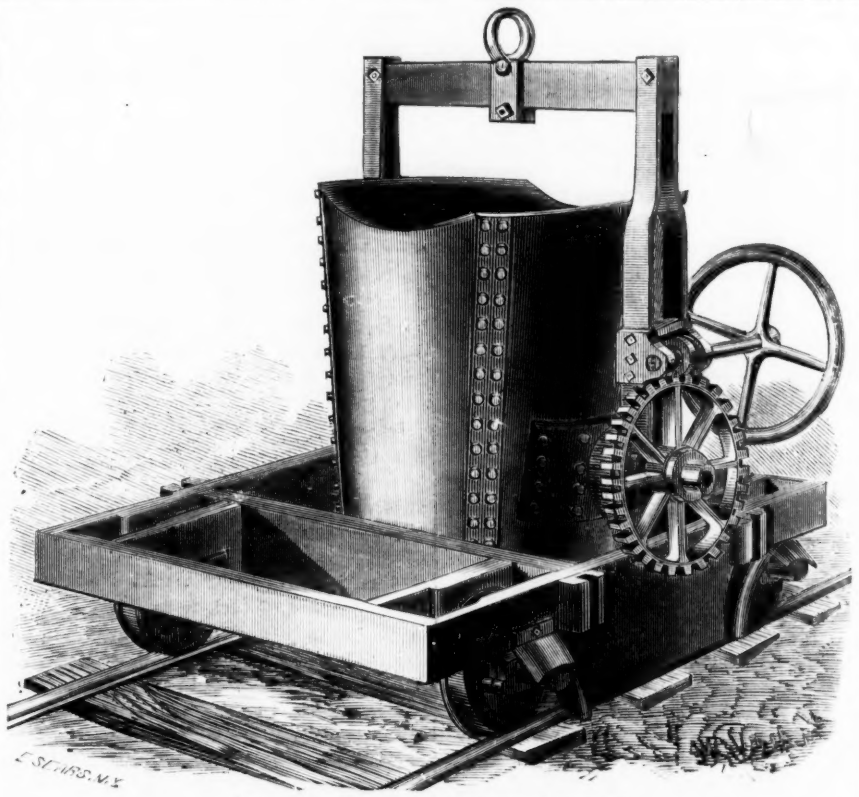
The pockets, as at *H*, *H*, are simply for the purpose of placing in arms should a wider carriage be desired. The carriage wheels are 16″ diameter, and are cast solid. The axles are wrought iron, 3″ diameter, and were cast in the wheels. Before the axles were cast in the wheels, they were used as chills to form the carriage's axle bearings. The axles at this time were $3\frac{3}{16}$″ diameter. After being cast in the wheels, they were turned down to 3″ diameter, in order to make them exactly central with the wheel rims, and at the same time to leave a little play in the bearings.

The cap, as seen at *R*, is made hollow, so as to form an oil box in which waste saturated with oil can be kept. The leathers over the axles, shown in perspective view, are for the purpose of keeping out dirt.

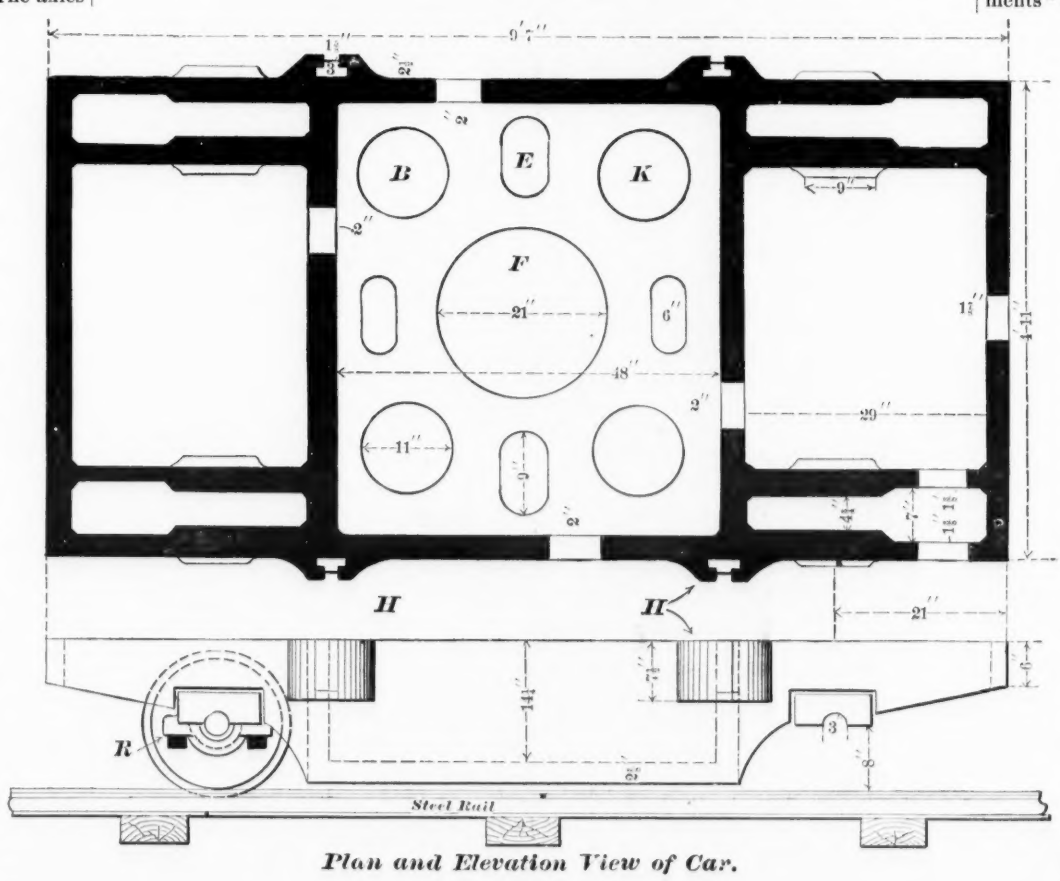
I think the practical man will see that the plan described is one which should cause a heavy carriage to run very easily. Although this carriage weighs about forty-five hundred pounds, two men can readily move it. For pulling heavy loads we have a wire cable arrangement which is operated by power.

The perspective view of car shows it loaded with one of our crane screw ladles, which for simplicity in design and good working is worthy of notice. The hand wheel is detachable, and the rim of same is made of wood. This prevents it from becoming hot from the ladle's heat, thereby leaving it free to handle.

While the carriage shown is applicable to but few shops, it may give ideas that sometime will come in play in others. To state the most weight such a car should carry is at its best but guess work. However, I would say that if squarely loaded over the axles the car should safely carry thirty tons.



COMBINED LADLE AND CASTING CARRIAGE.



Plan and Elevation View of Car.

Action of Sulphur in Fire-Boxes.

A good illustration of how engineering practice frequently produces cases where apparently the same conditions bring conflicting results was given during a discussion in the Master Mechanics' Convention. In speaking of steel and iron fire-boxes, a member expressed the belief that sulphur in the coal had an injurious effect on fire-box sheets, his experience leading him to that conclusion. Another member used coal which contained 2½ per cent. of sulphur, and it had no effect on the fire-box sheets, so the inference was that the other must be mistaken. This is one of the cases where both may be right, although the results were different. Sulphur has an affinity for iron, but a certain high temperature must be reached before combination is possible. Certain physical conditions are necessary before chemical combination can take place, just the same as the affinity of carbon for oxygen is quiescent until the temperature of the wood or coal is raised to an igniting temperature. In ordinary conditions, fire-box sheets will not get hot enough to permit sulphur to combine with the iron; but when the sheet is covered with lime scale, which prevents the water from absorbing the heat rapidly, the sheet may get hot enough to permit the chemical combination of sulphur joining the iron. There is no doubt but this often happens, and it explains why sulphury coal is most injurious to fire-boxes where the feed water is bad.

Persons traveling on the Mexican Central Railway are only allowed 30 pounds of baggage exempt from extra charges. The charges for extra baggage are so high that it is said to have the effect of decreasing travel.

In the Master Mechanics' report on boilers, the Walker smokeless locomotive, which was exhibited at Chicago last year, was mentioned. Great expectations were formed of that engine by many parties interested in the economical consumption of fuel, but the results have been disappointing. The engine ran for some time on several Western roads, mostly in an advertising way, but it has now disappeared. Like many other "improvements" designed for locomotives the Walker fire-box looked pretty on paper, and there was no difficulty in proving logically that it must be a success, yet it did not pass well through the searching ordeal of practice that all locomotive appliances are subjected to.

In Russia children under twelve years of age cannot be employed in factories, and between the ages of twelve and fifteen they cannot be employed more than eight hours per day, and must attend school at least three hours per day. Similar laws are enforced in Austria. It is only in countries that lay claim to "high civilization" that children of seven or eight years of age are employed in mills from ten to twelve hours out of the twenty-four.

The extension of manufacturing industries in the South has changed the tariff sentiment in many localities and the same kind of a change is rapidly being wrought in other localities. When there is no business to speak of, free trade notions are likely to find their strongest support. But as soon as manufacturing industries are established, and the benefit felt by all classes of business in the community, the people become favorable to protection, and cannot again be won over to the ancient free trade doctrine. People are educated slowly by argument, but rapidly by events.

Southern papers are again favorably noticing the cotton picking machine, invented by a South Carolinian. Should this machine prove as successful in operation as those interested in it believe, it will work a revolution in the tedious process of cotton picking.

New Shaft Coupling.

The engravings represent a new shaft coupling, recently introduced by Theodore E. and John P. Golden, of Columbus, Ga. As will be seen, the coupling proper consists of a divided sleeve *A*, which is bored slightly smaller than the shafts to be coupled, and provided with a key-seat *a* in one of the halves. This sleeve is made with taper or conical ends, and is recessed at and near its center. On this recessed part the collar *C* is placed, being bored sufficiently loose to slip freely over the ends of the sleeve. This collar (*C*) is threaded at the ends, *b*, *b*, to receive the nuts, *B*, *B*, which are coned or tapered to fit the corresponding ends of sleeve *A*. The collar *C* is provided with holes for a spanner wrench, as are also the nuts *B*.

To connect two shafts with this coupling, the halves of the divided sleeve *A* are placed on the shafts; the nuts are slipped over the ends and the key placed in position; then, by bringing the ends of the shafts together and screwing up the nuts, the halves of the collar are forced hard against the shaft in a manner clearly shown in the engravings.

By the use of this coupling it is claimed that security against working loose, and the requisite strength, are obtained by the use of a small amount of metal, and that the shafts are coupled and uncoupled with great facility.

General History of Stationary Steam Boilers.

BY WILLIAM LOWE.

SECOND PAPER.

EFFICIENCY OF HEATING SURFACE.

On consideration of this, it will be seen that that heating surface of the same kind and thickness, of same metal, whether plate, flue, or tube, which is nearest to the furnace, or in contact with the fire, or heat, laying in best position for receiving the heat, will be the most efficient, and that farthest away the least efficient, and other heating surfaces not so well placed have a *pro rata* efficiency. The relative value of heating surfaces is as follows: Horizontal, above the heat, one: vertical, one-half; horizontal, below the heat, one-tenth; and of the surfaces of flues or tubes, fifty-six one-hundredths. One square foot of surface, in contact with the fire, is computed to be as effective as three of total heating surface.

COMPARISON OF HEATING SURFACE IN RATING POWER OF BOILERS.

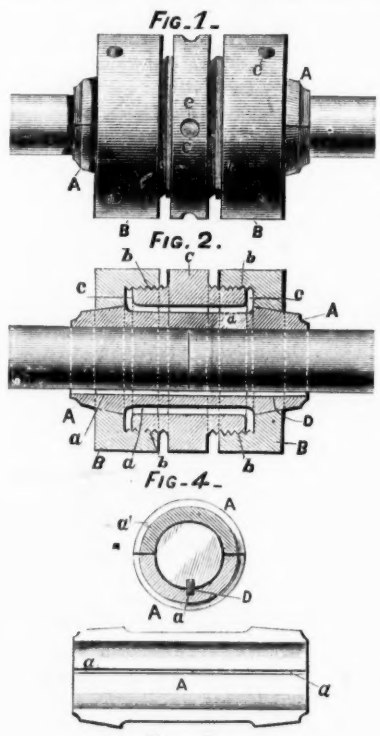
In this respect the writer has found, in his own practice, that there must be the following amounts of heating surface in the several types of boilers, to evaporate thirty pounds of water per hour (which is called one-horse power), with a satisfactory amount of fuel. Counting the total heating surface in the furnaces of internally-fired boilers, and the whole in the flues and tubes, and all that of the shells exposed to the heat, the amounts would be nine square feet—a square yard—in plain cylinder boilers; ten feet in flue boilers; and fourteen feet in tubular boilers. In internally fired boilers, ten feet, in those having large flues; and twelve feet in those with tubes from three to four inches diameter; in vertical boilers, and in boilers internally fired with a combination of flues and tubes, eleven feet.

In comparing the rating of boilers, we will take, for example, a fifty-horse power two-flued boiler, and a fifty-horse power return tubular boiler. The first would be 54″ diameter, 29 feet long, with two 20″ flues, which has a total heating surface of 500 feet—210 feet in shell and 290 feet in the flues—and if we take .56 of that in the flues as effective, we have 162 feet, to which add that in shell, 210 feet, and we get 372 feet, effective heating surface. Dividing this by 50 gives 7.44 feet of heating surface per horse-power, and which must evaporate 30 pounds of water per hour.

The 50-horse power tubular boiler has 700 feet of heating surface, and would be 54″ by 13½ feet, with 60 tubes 3″ by 13½ feet. There is 93 feet in shell and 607 feet in the tubes; .56 of that in tubes is 339 feet, to which add that in shell, and we get a total effective heating surface of 432 feet. Dividing this by 50 we get 8.6 feet per horse-power, to evaporate the 30 pounds of water per horse-power per hour. Dividing 30 by the 7.44 and by 8.8, we get as the duty per foot of heating surface per hour, in the flue boiler 4, and in the tubular 3.4 pounds of water evaporated per hour per foot of effective heating surface.

From this it would seem that the tubular boiler has the advantage over the flue boiler, but it has not, because of the better combustion of the gaseous portions of the fuel in the flue boiler against the very poor combustion of them in the tubes of the tubular boiler, together with the greater and quicker fouling of the tubes than the flues.

To continue the comparison farther, we will take the total heating surfaces of the two boilers and divide 1,500 pounds of water by them, which is the evaporation per hour for the 50-horse power, and we get 1,500 divided by 500=3 pounds and 1,500 divided by 700=2.14 pounds of water, to be evaporated per foot of total heating surface per hour; 3 pounds in the flue and 2.14 pounds in the tubular boiler. Carrying this comparison to the internally fired boilers, we find the same advantages in those with large flues over those with tubes, but in this type of boiler less heating surface is required, because it is of a more effective kind, in the furnace, and also in the flues, or tubes, which get the heat directly from the furnace.



NEW SHAFT COUPLING.

DUTY OF HEATING SURFACE.

The amount of work done by the heating surface of the boiler in a given time is the measure of economy of the fuel, and no comparison has any value, lacking this consideration. In the above comparisons it will be seen, that we have placed the duty per foot of heating surface per hour in the flue boiler at 3 pounds per hour, and 2.14 pounds in the tubular boiler. In locomotive and vertical tubular boilers, also in other internally fired boilers, with tubes, 600 feet of total heating surface would be right for 50 horse-power, and would have to evaporate 2.5 pounds per foot per hour. In plain cylinder boilers, at 9 feet, total 450 feet, it would be 3.3, and in flue boilers at 10 feet, 500 feet, it would be 3 pounds, same as above.

Any deviation from these proportions, in less amount of heating surface for the power, or greater power from this amount of it, will result in a greater consumption of fuel, for the power, *pro rata*, to the amount of work done by the heating surface, and any reduction of these duties will produce greater economy of fuel, down to one-third less duty. In boilers of same diameter, those having the thinnest plates, with same amount of same kind of heating surface, will produce the most evaporation from the same amount of same kind of fuel burned under or in them in a given time. A test was made to prove this, in two boilers of precisely the same size and kind, the one with ⅜″ plates, and the other with ½″ plates, and on burning the same amount of fuel of same kind, on same size grate, in a given time, the boiler with ⅜″ plates evaporated much more water to the fuel than that with ½″ plates. Besides this the water protects the thin plate the best.

HORSE-POWER OF BOILERS.

From the foregoing it will be seen how to rate the several kinds of boilers so that they will give satisfactory results from the fuel, and if the necessary consideration is given to determine the proper amount of boiler needed for the several purposes for which boilers are used, there need be no mistakes made in getting the right amount of boiler for the works that will do it with the least amount of fuel. This is the first consideration in the selecting and purchasing of boilers, because a very small saving of fuel in one boiler over another will amount to enough in the life of a boiler to buy a new one, and pay for much cost of maintenance. In my experience there is but little fear of buying too much boiler for the work. I don't know of any boiler user who has enough to get the most economical result from the fuel.

In gauging the horse-power of boiler for steam engine use, the kind of engine must be considered. If it is one of the most improved self-adjusting cut-off engines of 50 horse-power, the above rating of boilers would be right for it, but if of 500 horse-power ⅛-th less boiler would produce the same economy of fuel, from same grade of expansion in both engines. The reason for this difference is, the massing of power reduces the losses, both in engine and boiler, but mostly in the engine. If the engines are adjustable cut-off, positive cut-off or plain slide valve with lap, the boilers must be ⅛, ¼ and ⅓ larger respectively than for the first named, to retain the same economical use of the fuel in the boilers, to produce the additional amount of evaporation required. In the use of steam for conveying heat for any use other than running a steam engine, the horse-power of boiler is not what it would be as measured in an engine, but is the quantity of steam condensed in a given time, that will do the work which when known may be estimated in horse-power of boiler through the evaporation of 30 pounds of water per hour per horse-power, same as for engine use.

An illustration of this difference is found in warming dwellings, buildings, and factories and for heating and boiling liquids, etc. In such cases, the horse-power is determined by the condensation of steam per hour. In the engine it is determined by the amount of steam used, which is governed by the pressure, and the expansion, or elastic force of it, and the number of times expanded in the cylinder while doing its work. Through this it will be seen what quantity of boiler in horse-power is required for any of these purposes, to retain the same economical use of fuel in the boiler. Those not having the full knowledge of this subject are apt to assume that a 50 horse-power boiler is 50 horse-power for any kind of engine or purpose, and it may be made to do this work, but it will be at the expense of a *pro rata* loss of fuel, in accordance with the greater amount of evaporation it must do over and above its fair rating, which is fixed at 30 pounds per horse-power per hour.

The quantity of evaporation required may be from 30 to 50 pounds of water per horse-power per hour, according to the kind and size of engine, and its application to the work to be done, so that it will be seen, that the engine and boiler are two separate and distinct things, the duty of the boiler being to make the steam with as little fuel as possible, and the engine to get the most effect from it, and the very best economy of fuel is only obtained through best boiler and engine of proper size, and properly applied to the work to be done. It should be remembered that the forcing of boilers to do more than their fair rating results not only in the waste of fuel, but shortens the life of the boiler, and increases the cost of maintenance, and liability to accidents and delays.

SPACE OCCUPIED BY THE POWER IN BOILERS.

The greatest space is taken up by plain cylinder boilers of any diameter, that next less is by boilers with one or more large flues, and still less with boilers having tubes from 3 to 4 inches diameter. Plain cylinder boilers are not much used now. If they are 36″ diameter, and if the water line should be placed 6 inches above the center, we should have in each foot length of this size boiler 5½ feet of exposed heating surface, and as we require 9 feet per horse-power, we must have 9 times 50=450 feet for 50 horse-power. We get this in two 36-inch boilers, each 40 feet long, which would require to set 9 feet by 40 feet; same power in a two-flue boiler would be 54″ diameter, 29 feet long, with 2 20-inch flues, and would require 7′ 6″ by 31′ 8″ to set it. If we go to 7 feet diameter, 28 feet long, with the flue boiler we should get about 100 horse-power, in 10′ by 31′ 6″. In the return tubular boilers 50 horse-power would be 54″ by 13½′, and would require 7′ 6″ by 17′ 6″ space to set it, and 100 horse-power, 66″ diameter 16′ long, would require 8′ 8″ by 19′ 8″ space to set, so that it will be seen that the return tubular has the advantage of the least space required for the power over all the others.

ENDURANCE OF, OR WEAR OF BOILERS.

All conditions being equal, of the externally-fired boilers the plain cylinder boiler has the longest life, the flue boiler the next, and the return tubular boiler the shortest life. Of the internally-fired boilers, those with large flues have the longest life, and those with tubes the shortest life, and those with a combination of flues and tubes have a mean of life between the all-flue and all-tubular boilers. The controling points for wear are accessibility for cleaning and repairs, unobstructed circulation of the water and the passage of the steam to the steam room, and least antagonism in the expansion and contraction of the parts, plates, flues and tubes, and furnace construction and bracing and staying; and in regard to the heating surfaces those boilers which have none so placed that the heat can drive or hold the water from them, will last the longest of their class. In comparison, the plain cylinder and flue boilers are more accessible for cleaning and repairs than those with tubes, both in the external and internal-fired boilers, and the damaging strains from differential expansion of the parts are least in the externally-fired boilers, on account of their greater simplicity of construction. Of the internally-fired boilers, those of the cylindrical form, having cylindrical furnaces last the longest, and those with square furnaces the shortest time. The endurance of flues and tubes is in accordance with their thickness. Thus, 12 inches diameter will be ¼″ thick, and 24 inches $\frac{5}{16}$″ thick, and tubes 3 inches ⅛″ thick, and 6 inches $\frac{3}{16}$″ thick. Tubes are used as both fire and water tubes. The fire tube is one through which the heat passes, and the water tube is one through which the water circulates, with the heat around the outside of it. The fire tube has a much longer life than the water tube under the same conditions.

We now come to the most important point in the life of a boiler, which is the care of it, and, as this depends entirely upon the man who has charge of it, it will be seen that his knowledge of the requirements for keeping it in good order, and his honesty in doing it, is the gauge by which its life must be measured under the work it is made to do, be it reasonable or too much.

COST OF MAINTENANCE IN GOOD ORDER.

In this respect the simpler forms carry the least cost for maintenance in good order during their life, either with external or internal furnaces. Those with tubes cost the most, because the tubes are worn out generally long before the other parts, and they have to be re-tubed, which adds greatly to the cost of

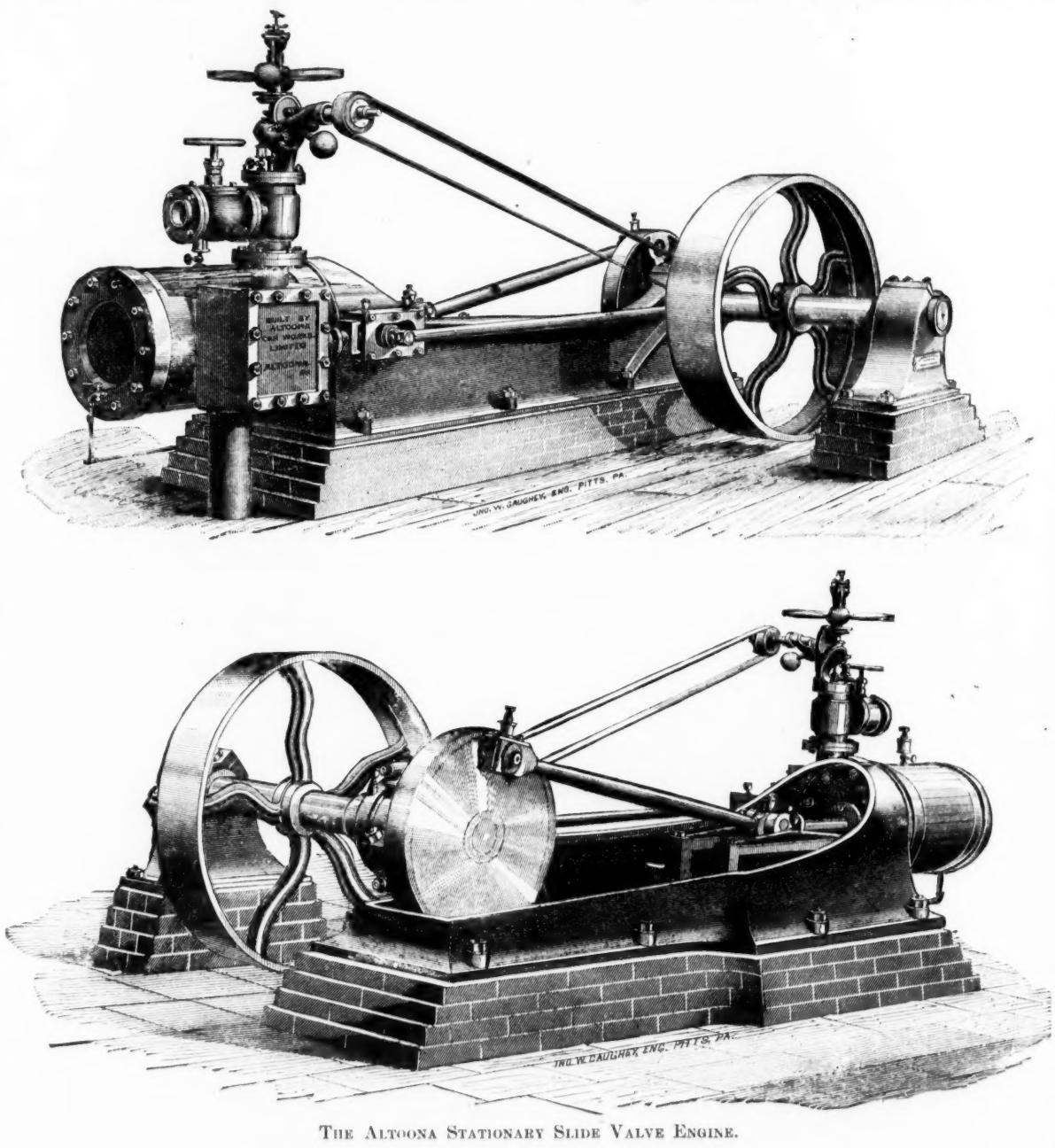
maintenance, the cost of the tubes being a large portion of the cost of the boiler. Accessibility for cleaning and repairs are great aids in reducing this cost and prolonging the life of the boiler, and no satisfactory results in any respect can be obtained with boilers which are inaccessible, even with the best water and care. Lack of consideration of this point leads many into great loss and trouble; and, on the other hand, too much consideration of it leads to great loss in fuel. In all boilers there should be all necessary provision for access to the internal parts, and manholes on all boilers, which are large enough to get into. All these necessary conveniences cost money, and to keep the first cost down they are left out oftener than honest people would believe. A case came to my notice lately where a party bought a locomotive boiler of 40 horse-power, and, when the inspector came to inspect it for a policy of insurance, to his great surprise he found no manhole in it, and could not see what was inside of it, yet this boiler came from a works of long standing and good business, but who sell at very low prices. This illustrates forcibly the necessity of having some one posted and honest to buy boilers for parties who do not themselves know what constitutes a good, reliable and accessible boiler, or buyers should place their confidence with boiler manufacturers whose record deserves it.

The Brooklyn Bridge, although in full operation, does not pay expenses. The trustees report the receipts for May as being much less than the expenditures. The toll for vehicles on the roadway is the same as on Fulton Ferry, and the one cent toll for individuals to cross on foot is the same as the ferry toll during the busy morning and evening hours. While the President of the Board was away in Europe, a trustee of the ferry company acted as President. It looks very much as though the Bridge is being managed in the interests of the ferry company, which has accumulated a million dollars surplus.

The *Locomotive*, published by the Hartford Boiler Insurance Company, says: "Crude petroleum is very effective in removing hard scale. But it should be put into the boiler when it is comparatively cool, after blowing down and cleaning out the boiler. The crude petroleum may be put in when the boiler is being filled; it will rise to the surface of the water, and as the water rises in the process of filling, the sides of the boiler will be washed by the rising oil on the surface. We have been able to remove hard scale in this way which could not be removed by any other process. Crude petroleum is volatile, and the amount of residuum which would result from the quantity used in a boiler for such purposes would be so small as to be harmless. We would not, however, advise the indiscriminate use of crude petroleum. If the water carries vegetable matter, or is liable to be muddy, other purgers will be better. But for a hard-lime scale we have found crude petroleum very effective. It will be observed that the conditions under which the oil is used in this case are different from those where it is introduced in the exhaust from the engine. In the latter case it is introduced into the water, which is at a high temperature, and may have more or less impurity or scum on the surface; the oil readily combines with this, sometimes causing serious difficulties. While in the former case the oil is introduced cold into cold water, it washes, or 'varnishes' the sides of the scale-covered boiler, penetrates it, works its way between the scale and the iron of the boiler, and detaches it. Those who have used petroleum to aid in removing a nut from a rusted bolt will understand its operation. It eats out or dissolves the rust or oxide without injuring the iron. So with hard scale, it works down between the iron and the scale, eats out or lubricates the film of oxide, and detaches it."

Stationary Slide Valve Engine.

The engravings represent two views of the slide valve engine made by the Altoona Car Works, Limited, Altoona, Pa. In the bed of this engine the spread upon the foundation is large, giving stability, and a good proportion of metal is distributed along the center line to avoid springing. The pillow block is cast in one piece with the bed, to avoid yielding and getting out of alignment.



THE ALTOONA STATIONARY SLIDE VALVE ENGINE.

The main shaft is of hammered iron, with bearings of good diameter and length. The crank pin, crosshead pin, valve stem, piston rod, and other important parts are of steel.

The connecting rod is forged solid, and the ends slotted for boxes adjustable by wedge and screw.

The guides and crosshead are of the locomotive type.

The piston is as light as is consistent with strength, and has a length equal to one-half the diameter of the cylinder. It is packed with two self-adjusting rings, no bolts or springs being used.

The ports are in length equal to the diameter of the cylinder, which provides for taking steam quickly, and for free exhaust.

The crank disk is accurately counterbalanced.

The Waters governor, with stop motion is used, which avoids any danger from running away should the belt break.

About ten years ago a powerful steam stone-breaker was exhibited at Paris, the foundation being of ordinary masonry. So much was the surrounding ground shaken that an engraver on glass, carrying on business in the neighborhood, suffered great inconvenience, being absolutely unable to pursue his vocation. He applied for a temporary injunction, restraining the proprietor of the stone-breaker from using the machine. The foundation of ordinary masonry was then removed, and one of asphalt substituted, when, upon testing the machine, it was found that no more tremor existed, and peace was restored.—*The Industrial Review.*

Notes of Master Mechanics' Convention.

The Committee on Boilers presented a list of what were called "unsettled questions in boiler construction," which were submitted for consideration. Among these were:

"What is the proper diameter of flues for locomotive boiler?

"What should be the space between the flues, and what their geometrical arrangement?

"What is the proper grate area and the amount of air passages needed for combustion of bituminous coal?

"Is the increased cost of the wagon-top boiler justified by the improved results in actual practice?

"Where is the best point to deliver feed water?

"What economical value have fire-brick arches?"

In this list of questions, the longest discussion arose on the first one.

Mr. Lander contended that forty years' experience had brought all the mechanical world to agree on nearly one standard, and that was about two inches diameter for flues. He believed in the survival of the fittest, and in this case the fittest was the two-inch flue. In Europe they inclined to a smaller diameter than two inches, while the Pennsylvania people were disposed to make the diameter greater. Several speakers favored a less diameter than two inches, but the majority thought that size could not be judiciously reduced.

Some discussion was raised about the value of brick arches and the proper method of supporting them.

Mr. Flynn saw no merit in the brick arch, and thought it caused waste instead of saving fuel. The opposite view was taken by several speakers.

Mr. Setchel did not think it was practicable to use water tubes to support the brick arch in regions where the feed water was hard. In addition to giving trouble by burning out, he assumed their tendency was to carry the mud from the leg of the boiler up to the top of the fire-box and to deposit it on the crown sheet. He thought angle irons riveted to the side sheets offered the best support for the brick arch.

Mr. Hatswell, F. and P. M. Railroad, had used water tubes for supporting the arch, and he found they tended to keep the crown sheet clear of mud. He made a special examination of a fire-box having these tubes after it had been in use over a year, and found the crown sheet the cleanest on the road. His experience indicated that the brick arch performed good service in preventing the flues from leaking.

A recommendation was made that original or construction tests of boilers be made by hydraulic pressure through injectors. This elicited no comment.

The hour for discussing short questions having arrived, Mr. Eastman submitted the query: "Should we not protect our locomotive fire-boxes with some covering so as to prevent loss of heat?" He said that over 100 square feet of surface was exposed directly to the air, and the loss from radiation must be great. As that part cannot be lagged conveniently, he suggested that a sheet covering be put on and held in place with studs.

Mr. Setchel raised the question: "What is the proper position for a cup to oil an injector?" It appears there is a diversity of practice in this matter, some placing the cup on the steam pipe while others put it on the water pipe. He thought most of the oil was lost when the cup was placed on the water pipe. Several other members coincided in this view.

Mr. Devine asked: "What is the best form of piston packing?" He had tried nearly all kinds of packing ever brought out, and believed he got the best results from phosphor-bronze rings.

Mr. Setchel's experience led him to favor packing with T-head and ring sprung over it. Thinks some other kinds of packing would give better results if it could be kept out.

Mr. Sprague uses a ring sprung into a groove; compresses the ring before he turns it, and finds that it then remains perfectly round.

IMPROVEMENT OF THE LOCOMOTIVE.

The committee appointed to consider this subject—Wm. Woodcock and Amos Pilsbury—reported that very little change or improvement had been made during the past year. They note a tendency, as expressed in com-

munications received by them, towards larger boilers and increased steam pressure, larger boilers being necessary to furnish steam for the increased speed called for. Larger boilers and higher pressure required stronger boilers, and the giving of more attention to the selection of material, the manner of riveting and the strength of the bracing. The committee believed that, while there was still room for improvement of the locomotive, the field was diminishing. They considered the locomotive of the present day well adapted for the service required.

The Brooks Locomotive works had recently built an engine with a Coventry boiler, which was the return flue principle applied to locomotives. The results of operating this engine were awaited with interest. Mr. Mitchell of the Lehigh Valley Railroad had departed from the ordinary type in building an engine for working mountain grades. The Schenectady Locomotive works are building soft coal engines with the fire-box widening above the frame.

The committee appointed to investigate the subject of "smoke stacks and spark arresters," report that the subject embraces too large a scope for one year's work. They recommend that a committee be appointed with power to enter into experiments for proving the value of different devices, the expenses to be defrayed by railroad companies.

The report on "shop tools and machinery," a synopsis of which will be given in a future issue, elicited no discussion of any consequence.

LOCOMOTIVE TRUCK AND TENDER WHEELS.

The committee on locomotive truck and tender wheels reported trouble in getting reliable data, having received but few replies to circulars sent out. Of the thirteen replies received, nine were in favor of steel tire wheels; three favored chilled cast iron wheels, and one undecided. One of those whose preference is for cast chill wheels thinks the plate wheel better than the spoke wheel, because it is easier kept clean, and is less liable to fan the dust up into the working parts of the engine. He has 24 Allen steel tire wheels in service in engine trucks, and finds the rapid abrasure of the flanges is such that they need to be turned off to obtain a better flange before the tread of the wheels required turning. He thinks the cast wheels are safe enough where a careful system of inspection is maintained.

One prefers a wheel with cast center and steel tire. The committee conclude their report as follows:

From all information obtained from the replies received, your committee have been able to decide first, that although from the number reported there is largely an excess of chill cast wheels in use, the preference is for steel tire wheels. This preference is divided among several makers. But little trouble has been experienced from steel tires coming loose. Respectfully submitted,

C. H. CORY,
R. C. BLACKALL,
J. B. ROSS,
Committee.

The report did not pass without challenge.

Mr. Setchel did not think a steel tire safe unless it was bolted on. He had found much trouble keeping the flanges from cutting.

Mr. Lander favors the steel tires, but has not accurate data wherewith to prove comparatively their merit.

Mr. Flynn saw only one advantage the steel tire had over the chilled wheel, and that was, that it ran smoother and more noiselessly. He knew the chilled wheel was cheaper than steel tires and he considered it practically as safe.

Mr. Eastman had experience with different kinds of steel tired wheels, and kept data to show their value in service. One set of steel tires had run continuously for three seasons, making over 150,000 miles and they were still in good order although they had never been turned. The road is very crooked. He thinks steel tires preferable to cast iron wheels, but thinks it makes much difference what quality of steel is used.

Mr. Warren has nine engines with Allen paper wheels in their trucks, and has no more trouble with the flanges cutting than he has with cast iron wheels.

The report on balanced slide valves, that has already appeared in the AMERICAN MACHINIST, was read.

Mr. Woodcock had tried nearly all the balanced slide valves ever brought out, and abandoned most of them. A few years ago they put in the Allen valve and it cut the seat so rapidly that they had to be faced every four or six weeks. Then they tried the Allen-Richardson balanced valve and it relieved them of the trouble with cut seats.

Mr. Barnett testified to the excellent results he obtained by using the balanced valve. An engine with this valve ran for twenty-four months without having the valves faced, and when the cover was taken off the valve was found in good order. Great care and skill must be exercised in fitting the strips on top of valve to keep them in order. He thinks the vacuum relief valve on steam chest indispensable with balanced valves.

Several other members spoke in a similar strain, some of them using the Morse balanced valve with good results. Some diversity of opinion was expressed about the kind of spring that was most suitable for keeping up the strips of balanced valves. The majority favored thin elliptic springs because they were not so liable to choke up with tallow and dirt as spiral springs were.

The last discussion of the meeting followed the reading of the report on "the best methods and material for lubricating valves." The preference of the speakers was sight-feed automatic cups. The general opinion was that they saved oil and gave the supply of lubricant at the time when it was needed.

Several papers were read which elicited no discussion, and other papers were passed without being read.

A resolution was passed adopting the Pratt & Whitney gauges for round iron. It was further resolved that test gauges of that make be purchased for the use of the Association, and that members decline to purchase iron that does not conform to the gauge measurements.

Mr. J. H. Flynn, Western & Atlantic Railroad, was elected president, and Mr. J. D. Barnett, Midland Railroad, and Mr. W. Woodcock, Philadelphia and Reading Railroad, were elected vice-presidents. Mr. J. H. Setchel was elected secretary for the fifteenth time.

LETTERS FROM PRACTICAL MEN.

Zinc to Prevent Boiler Scale—Bridge Walls.

Editor American Machinist:

Mr. W. E. Crane raises some interesting points in his communication, published in your July 5th issue. As to piston valves, I entirely agree with him in believing their extended use would prove advantageous. In regard to the use of zinc in boilers, I will say the first I ever heard of it was some dozen years ago, when a marine engineer left a piece in a boiler by mistake, and in a communication to some paper told of the disappearance of the zinc, and the improved condition of the boiler when opened some ten days later.

At that time, having charge of boilers that were inclined to scale, I tried the zinc with good results.

My practice was to suspend a pound pig of the metal by a wire to about the water line. It would disappear in two or three weeks. At present, my feed water being good, I have no occasion to use it. I should not, under any circumstances, put it in contact with the boiler, or use it in such a quantity as in the case cited.

On the subject of bridge walls, there seems to be a great variety of opinion. I have boilers under my charge set in both ways, with straight and curved walls, and I must say I can see little or no difference in their steaming capacity. I believe, however, that the grate should be 28″ or 30″ from the shell, and the bridge wall at least 6″ or 7″. I have got good results from building them on a curve, the ends of which join the side walls half-way between the circle of the boiler and a horizontal line even with its top at the lowest place. Opinions also differ as to the space back of bridge wall. I prefer a gradual slope from top of wall to back connection, making it easy to push back and remove any accumulation of ashes or soot.

P. H. BULLOCK.

Warnerville, Mass.

Kaolin as Boiler Covering.

Editor American Machinist:

Some time since I sent you some notes concerning a boiler covering used by Mr. Cochran, master mechanic of the South Carolina Railroad, at Charleston, S. C. I have noticed Mr. W. M. Barr's objections to it, which also appeared in your paper. I have seen boilers corroded by different coverings, and I especially questioned Mr. Cochran concerning this point. Out of some thirty odd engines covered with kaolin he had never found the slightest indication of corrosion. I was shown a boiler, in for repairs, that had been covered for three years with kaolin, and the original skin and color of the iron as it came from the roll, was still as distinct as the day the iron was put into the boiler. The adage, that an ounce of practice is worth a ton of theory, appears to have especial application in this case.

FRANK C. SMITH.

Equalizing Pressure in Steam Boilers.

Editor American Machinist:

I have noticed several communications lately upon the question of letting steam from one boiler into another under different pressures. A little information, based upon practice, will, perhaps, be of interest to your readers. In the old mills of these works there are forty-six boilers—forty of them placed over heating and puddling furnaces, and six of them fired by hand. Each of these boilers is provided with a stop valve, so that it can be connected or disconnected with the general system of steam pipes into which all deliver their steam. It is a practice of almost daily occurrence to disconnect and connect some of these boilers. Having a surplus of steam in the mills, we have lately connected their system of steam pipes with that of the machine shops by a steam pipe of more than 500 feet in length. Equalization (as we call the process) is made between the two systems without any reference to the different pressures. The whole secret lies in having ample drain pipes in the connecting steam pipe, so as to give free vent to the water formed by condensation, and in opening the equalizing valve very slowly, our plan being to open about $\frac{1}{8}$″ of a turn and then wait for several minutes; then open another $\frac{1}{8}$″ of a turn and wait again, taking about half-an-hour for the full process. A sudden opening of the valve will make a great commotion in the boilers, and is undoubtedly attended with danger.

R. H. DAVIES,
Master Mechanic, Phœnix Iron Works,
Phœnixville, Pa.

The Real Meaning of Theory.

Editor American Machinist:

Let me suggest, briefly, that a meaning is often given to the word "theory," even by some of those who, in other respects, speak very accurately, which is quite incorrect, and which causes needless difficulty in explaining the supposed difference between a "theoretical" and a "practical" man. To theorize, in the true sense, is to study and to compare. Hence, in a machinist's sense of the word, a man must have at least one fact to study, and also several facts, if he wishes to compare one with others. The result of his theorizing, then, must be, if done intelligently, an actual advance in his knowledge of the single fact, if he had but one in mind, and also a genuine and useful widening-out of his view of the subject, if his series of facts had been well chosen or placed before him.

It must be clear, then, that the man who has the largest store of facts to draw upon in his study of a subject, that is the so-called "practical" man, is really the most theoretical man in his more complete and definite study based upon this groundwork of facts. Some men have difficult questions put to them for an answer, to which their "theorizing" in this way often aids in the most telling way, while the common supposition too often gives them credit for being only "practical" in the simple, thoughtless sense. No man can possibly be "practical" in any useful way excepting as he brings his thought and study of facts to his assistance every day. In other words, the most practical man is the one who theorizes most, using the words in their most natural and correct sense.

P. BARNES.

Worcester, Mass., June 25, 1884.

The Central Pacific Railroad Employes' Library at Carlin, Nevada—Humboldt Division.

Editor American Machinist:

The Central Pacific Railroad Employes' Library at Carlin, Nevada, was a conception of Mr. A. J. Stevens, general master mechanic of the road, and was first instituted in 1873, and up to January, 1880, continued to flourish in a remarkable manner, when by some accident the building took fire, and, with its contents, was totally consumed. A few hours after the fire had occurred, steps were taken by employes to found another library, and which now contains the books, etc., as per catalogue, which I send you. I also send you a copy of our constitution and by-laws, which, if given publicity, may induce and aid other railroad employes in founding similar institutions to ours.

The Central Pacific Railroad Company have taken great interest in the progress of the institution, and libraries have been established at many other of their division shops with much success, notably that at Wadsworth, Truckee division, under the very able management of Mr. Gregg, division master mechanic, assisted by employes.

I may state that Mr. Stevens, general master mechanic, has been most untiring in his efforts to establish libraries and promote the comfort of employes, and it is to his encouragement and exertions, and to the liberality of the Central Pacific Company, that the library at Carlin owes its success.

I append a list of newspapers, journals, etc., which we receive for the use of readers: AMERICAN MACHINIST, *Mechanical Engineer*, *American Engineer*, *Mechanics*, *Scientific American*, *Scientific American Supplement*, the *Engineer*, of London, Eng.; *Engineering*, of London; the *Railway Engineer*, of London; the *Railroad Gazette*, *Railway Age*, *Railway Review*, *Van Nostrand's Engineering Magazine*, *Engineers' Journal*, *Firemen's Journal*, U. S. Patent Office Reports, *Harper's Weekly*, *Leslie's Weekly*, *Graphic*, *Illustrated London News*, *Illustrated Weekly Christian*, New York *Graphic*, *Harper's Magazine*, *Puck*, *Quarterly Review*.

And, in addition to the papers, etc., mentioned, we subscribe for and receive twenty-one daily and weekly papers, and I may state that at the end of each week all the papers that have been read (except those treating on mechanical subjects) are taken from the tables of the reading-room and are made up into parcels, put in neat wrappers and distributed free of cost to the various section-houses on the division, which is 201 miles in length, and, where the section men are married, illustrated papers are also sent for the use of their wives and families, and it is not necessary that they should be members of the library in order to receive the papers. The institution is supported by a monthly subscription of fifty cents from each member, and the Central Pacific Company very generously supply, free of cost, the fuel and oil used in the institution, and, in fact, give us encouragement in every possible way. To show how much they appreciate our efforts, I enclose for your information a copy of a letter sent by C. F. Crocker, Esq., vice-president of the road, to the officers and members of the institution. It is a very fine letter—too good to be kept from the public, as it makes some excellent points in favor of institutions similar to ours.

I may add, in conclusion, that books are sent from the library to every part of the division.

WM. FRASER SMITH, President.
DANIEL WRIGHT, Vice-President.
P. MORSHEAD, Secretary,
Carlin, Nev.

[The letter from Vice-President Charles F. Crocker to Mr. Smith is as follows:

"A copy of the catalogue of your library for the year 1883 has been placed in my hands, and been examined by me with surprise and pleasure. I am surprised because earnest efforts in the direction of this undertaking are not more frequent, and pleased because of the gratifying success you have met with, as shown by the catalogue. I have noticed the progress you have made, almost since the establishment of your library, with approval and interest, and am particularly pleased with the large proportion of works of science, biography, history and travel, art and essays, which appears in it. I have not counted your books by title; but, estimating from the pages and the average contents of the page, the number of volumes on your shelves appears to be about 2,000. I estimate of these the proportion of the class of works cited above to be about 50 per cent., and of the remaining 50 per cent. it is a pleasure to note a large proportion of standard poetical works, and the higher literature of romance and fiction.

"In these features your library compares well with the best circulating and free libraries on this coast. The entire effort you have made and the success attending it illustrate the value of associated effort in the way of improving the social and intellectual advantages of places remote from great centers of social and literary influences. Eminent writers on political economy and other thoughtful men have deplored what they term the "Decay of the rural spirit" in our country. They have regarded the tendency of our population to crowd into cities as a serious menace to the future of our industrial systems. This tendency has been attributed to the social and intellectual disadvantages of country life. You of Carlin, have given us an example of how these disadvantages may be modified if not all overcome. You have a library comprising the best works of English literature, and you have all these works as accessible to your members as if each owned them. You have provided yourselves with a comfortable place for social reunion, and by these means you cannot have failed to very greatly enhance the moral, social and intellectual character of your members, and exert a valuable influence on the general character of the town of Carlin.

"In writing this I have been prompted by a desire to convey to you and, through you to the members of your society my earnest commendations and sincere respect for the effort you are making, and my hearty congratulations upon the degree of success which has attended your work. It would be a source of great pleasure to me and the other directors of the company to know that your example had been followed by the employes at towns similar in location and character to the railroad system at Carlin.

The "Perfect Screw Problem," and How to Keep the Screw Perfect.

Editor American Machinist:

In the discussion which followed the reading of Prof. Rodgers' paper, at Pittsburgh, on the "perfect screw problem," several plans were suggested for maintaining the accuracy of the screw when used in the ordinary lathe. While there are a few lathes in use in which the lead screw is used its entire length, in a very large majority of lathes a long screw is never cut. Probably not one in one thousand of the screws cut in ordinary machine shops exceeds one foot in length. In all the lathes of this class it is as impossible to make a lathe to cut a perfect screw throughout its entire life time as it is possible to make a perfect screw 12 inches long. I entertain the opinion that the following plan promises better results than any other yet presented:

Dispense with the present form of lead screw, and substitute a feed rod, perhaps somewhat larger than the feed rod now used in the New England lathes. Place upon this feed rod an adjustable sleeve a foot and a half long, more or less, and have at one end of this sleeve, for 10″ or a foot, a perfect thread, and in the apron of the lathe an open nut of the same length. The result will be a perfect screw and nut of the same length, long enough to cut screws 16″ or 18″ long and adjustable anywhere along the lathe. The sleeve, of course, would have a set or binding screw to secure it to the feed rod.

To secure its proper use the following practice would need to be observed: In setting the tool, bring it to the center of the thread to be cut, slide the sleeve so the end of the screw is even with the end of the nut and make it fast on the rod. This would always insure the screw working equally out of the nut at each end.

The only reason I have to hope that this plan will be tried is in the fact that it will be a cheaper arrangement than the old one; still it will not be done unless some one, other than a manufacturer, does it, for such a lathe could not be sold in the open market without the builder having to spend more money to sell it than he would save on the long screw.

I record the above prophecy for the purpose of showing that I am gaining in knowledge, and for the opportunity to explain how I gained it.

In conversation with Mr. Gray, of Cincinnati, about lathes, I asked him why it was that they all persisted in running the slide on two V's? His reply was "that he knew that one V and one flat was correct," and that he made his "first lot of twenty that way, but it cost too much to sell them."

JOHN E. SWEET.

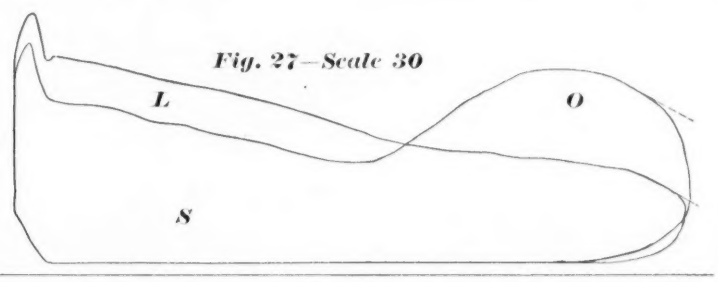


Fig. 27—Scale 30

The Indicator Diagram.

BY F. F. HEMENWAY.

THE EFFECT OF A LIGHT FLY-WHEEL.

The diagram *S*, Fig. 27, is from a 10½″x20″ throttling slide-valve engine, running 102 revolutions per minute. It affords a good illustration of a loss occurring in this class of engines, that is, I believe, much more common than it is thought to be—a loss resulting from the attempt to bring about good regulation in connection with a fly-wheel too light for the purpose. To this end a first-class sensitive governor will be used, the result being the regular number of revolutions per minute, and the use of materially more steam than would be used with a less sensitive governor and poorer regulation. The question of the capacity of fly-wheel is seldom considered further than its influence on regulation is concerned, and even then a certain number of revolutions per minute is quite generally thought to be all there is of regular speed.

As a matter of fact, the fly-wheel often has an important bearing on the fuel economy in any class of engine, either throttling or automatic cut-off, where the speed is controlled by the operation of a governor.

The steam line of this diagram has, at the beginning, the proper direction for producing a good throttling diagram, that is good for the amount of work being done, but somewhat later than half-stroke the governor valve opens suddenly, apparently its full capacity, admitting steam till near the end of the stroke the pressure exceeds the initial pressure by six lbs., and this at a time when the steam thus admitted can do but little work before it is exhausted. This admission of steam late in the stroke, so that the terminal pressure measured from atmosphere is, in some instances, equal to or higher than the mean effective pressure, is the loss referred to as likely to result from the use of a light fly-wheel and a good governor.

The engine from which this diagram was taken was bought second-hand, but was in good condition, and had well-designed, ample ports. It had, also, a fairly-proportioned fly-wheel pulley, but it being inconvenient to belt from this fly-wheel, and a fly-wheel being nothing more than a pulley to the parties who bought and put the engine up, a pulley of less diameter and less than one-quarter the weight was substituted.

Starting at the beginning of the stroke, and assuming the diagram from the other end of the cylinder to have been a duplicate of this (which it was very nearly), the action of the governor and influence of lack of fly-wheel can be studied. Thus the speed may be assumed to be normal at the beginning, and the governor valve in about the right position, but the steam-chest pressure is too low. With the light wheel and the low steam-chest pressure—the latter the indirect result of the former—the speed falls off, so that at about mid-stroke the governor is induced to act, which it does by fully opening the valve; then, there being but little resistance in the wheel, the speed was accelerated sufficiently to quite close the governor valve at about the time the lap of the slide valve operated to cut off steam. It seems probable that the valve remained closed until about the time (or a trifle later) steam was admitted for the return stroke, the steam required to fill the clearance space accounting for the initial pressure being less than the pressure in the steam chest at the time of cut-off. To make this diagram would require about 75 lbs. of water per horse-power per hour, and the boiler required such hard firing to evaporate the quantity of water necessary that more than 12 lbs. of coal per horse-power were burned; in fact, but for the difficulty in keeping steam, the engine might still have been running as it was when this diagram was taken, as the governor kept the speed *in revolutions per minute* very regular, and the indicator was applied to the engine *because the boiler was too small.*

To remedy matters, and keep the small pulley to belt from, a fly-wheel with a narrow and deep rim was put on beside the pulley, and without further change the diagram *L* was taken, which, for convenience of comparison, is engraved on the same block with diagram *S*. This is a very good throttling diagram, with the exception that the cylinder is too large for the work, which brings about low initial pressure. The water required when this diagram was taken would be about 50 in place of 75 lbs.—a saving of 33 per cent. The saving in coal was more than this, as decreased consumption brought about more economical use.

The only other faults of the diagrams are too little compression to insure smooth running, and—if it is a fault—a slight lack of lead.

Professor Calvert has recently made the interesting discovery by practical tests, that the carbonates of potash and soda possess the same property of protecting iron and steel from rust as do those alkalies in a caustic state. Thus it is found, that, if an iron blade be immersed in a solution of either of the above carbonates, it exercises so protective an action, that that portion of the iron which is exposed to the influence of the damp atmospheric air does not oxidise, after so extended a period as two years. Similar results, it appears, have also been obtained with sea-water, on adding to the same the carbonates of potash and soda in suitable proportion.—*Mechanical World.*

The fifth annual reunion of the Amalgamated Association of Iron and Steel Workers, held at Beaver, Pa., on Saturday, June 7, was attended by about 20,000 people. Delegations were present from Wheeling, Youngstown, Niles, Pittsburgh and other iron centers, and the reunion was a success.

On the 3d of June the Commissioner of Patents issued a patent, No. 290,505, on an improved steam boiler, to Edgar Badlam. The patentee, a son of Alexander Badlam, is only sixteen years old, and has the honor of being the youngest patentee in the United States. He has several other applications for patents pending.—*San Francisco Evening Post.*

A new question is bothering local politicians in Texas. Many farmers and planters are accustomed to mortgage their crops as soon as the seed is put into the ground. This year the freshets swept away the growing crops in many localities, and, being late in the season, seed of another kind was sown. The question is, does the mortgage hold good on the crop raised from the second sowing? Local party lines have been drawn on this issue, and it promises to be as important in deciding the fate of local aspirants for political fame as the hog question in some Western towns. In many towns the question whether hogs should be allowed to roam at large in the streets is greater than the tariff question.

The master plumbers and journeymen plumbers each have a trade union in New York City. Owing to some difficulty about time of quitting work, the former union tried to break up the latter, and to this end ordered a lockout of all union journeymen plumbers. The journeymen are industriously setting up business on their own account, and the union offers financial guarantees for the proper fulfillment of contracts, large and small. If this transformation goes on long enough, we may expect to see the journeymen's union order a lockout of all union master plumbers.

The business of granting Government subsidies to railroads in Mexico does not seem to be any more satisfactory to the people of that country than the same policy has been to the people of the United States. The *Mexican Financier* says:

"All railway lines which are worth building ought to be able to command private capital to carry them into execution. If they cannot do this, they should not be built at all. It is the height of folly to cover the country with a net-work of 'wild-cat' railways which traffic prospects for a half-century to come will not justify. Several of these lines might be mentioned which, through their subsidies, are in reality built by the Government and made a present of to their owners."

The *National Car Builder* says: "It is a common remark, even among railroad men, that iron cars will sooner or later come into general use, in view of the fact that timber is getting scarce and more expensive, and that the supply must ultimately run short. The inventors and advocates of iron cars must therefore bide their time. If they think, as some of our correspondents evidently do, that we are too apathetic in helping along the reform they have so much at heart, how exasperated they must be at the snail-like progress of the Car Builders' Association in this matter, as evidenced by the brief and inconclusive reports made from time to time by the long-continued committee on 'Iron and Steel in Car Construction.' In its report made last year the committee intimate that all are of one mind on the subject, but that each is waiting for somebody else to take the lead, that it has taken many years to bring wooden cars to their present excellence, and it should not be expected that iron cars can be perfected all at once."

Two-Spindle Valve Milling Machine.

This machine is one especially designed and manufactured by Warner & Swasey, Cleveland, Ohio, for milling the square and hexagonal parts of valves and other brass goods. The two spindles, which in operation mill two sides of the work at once, are independently adjustable, by means of the hand wheels shown at the ends of the machine, and can be brought together or separated any distance not exceeding eight inches.

The piece to be milled is screwed to its proper position on a sliding rod within, and projecting a short distance above the upright spindle, and then drawn firmly against the spindle by the large hand wheel shown below.

After milling two sides, a partial revolution of the valve through 60° or 90° is obtained, by giving the lever, shown just above the hand wheel, a forward movement which unlocks the spindle, turns it the proper distance and locks it ready for milling the next two sides.

The upright spindle has a taper bearing its whole length, thereby obviating all tendency to chatter. The sleeve to which this spindle is fitted is adjusted vertically by the lock nuts, shown in the cut. It is then firmly clamped by the binder screw, shown at the end of slide. Hardened steel indexes are furnished for square and hexagon milling.

The countershaft has 10″ tight and loose pulleys for 4″ belt, which should run 375 revolutions per minute. Weight, ready for shipment, 900 pounds.

Hitherto the Mexican Central Railway has been burning wood in the locomotives of all trains, owing to the difficulty of getting coal. Arrangements have now been completed to use coal in passenger engines, and as soon as possible the same kind of fuel will be adopted for all locomotives.

English Versus American Boilers.

BY GEORGE MARSHALL.

In a recent number of the AMERICAN MACHINIST, under the heading "Money Value of Steam Boilers," a correspondent makes comparisons between the Galloway, Cornish, and Lancashire boilers, and the horizontal tubular boiler so generally used in this country, and with a slight preference in favor of the English styles. While his arguments and theories are in the main correct, still it would be well for steam users to carefully consider arguments from other authorities in regard to the general merits of both types before hastily arriving at the conclusion that owing to the forty years' use in Great Britain and on the Continent, of the English types their superiority must be considered as an acknowledged fact. It is generally known among boiler makers and steam users that more given horse-power can be plaed in a less area by the use of the horizontal tubular style than by any of the English boilers to which reference has been made as above. It is also a fact well known to boiler makers, steam users and competent inspectors, that the durability of the horizontal tubular exceeds that of either of the other types, while for ease of repairs and facilities for cleaning the tubular boiler far surpasses nearly ever other boiler known.

The fact being stated that greater horse-power could be placed in less space by the use of the horizontal tubular, to establish the claim a reference must be made to some known and recognized authority, and for this purpose a reference to an English work by an English author is, perhaps, the best that can be made at this time. In a treatise on steam boilers, by Robert Wilson, C. E., a well-known English authority, referring to the horse-power of boilers, he says that "in a Lancashire boiler 7′ diameter, 30′ long, and having two flues 2′ 9″ diameter, we have 375 square feet of surface, which, divided by 8, gives 47 horse-power." According to this authority we have a space more than three times as great required for the setting than would be required for that of the horizontal tubular; and the same authority also states, in another part of his most excellent work, that "In order to increase the amount of heating surface and the strength of the large internal flue tubes, as well as to improve the circulation of the water, small transverse water tubes have been added to the main tubes. The most conspicuous example of this modification of the Lancashire is the Galloway boiler, which has long found favor with steam users. The weak elliptical tube, when its form is not too irregular, can be adequately strengthened by the vertical conical water tubes, and the whole made capable of sustaining as great a pressure as any of the internally-fired class enumerated. It must, however, not be forgotten that the advantages just mentioned are *gained by the sacrifice of simplicity, and they increase the difficulty of examination, cleaning and repairs.*"

Mr. Samuel Nicholls, foreman of a boiler shop in England, and one of the most prominent men in such a position, also says in his "Theoretical and Practical Boiler Maker:" "The conditions under which steam boilers work in America are, as a rule, so different to those prevailing in this country, that while the ordinary rule for describing the power of a boiler may suffice in Great Britain, in the United States something more is desirable. There higher pressures are required, and the maker has to furnish heat-absorbing surfaces of greater strength, and as this means money, we are afraid there is a great temptation to give the surfaces without the requisite strength; the practice in the United States being to work with a much lower factor of safety than is the rule in this country. Be this as it may, however, boilers are frequently worked in America at a pressure of 80 pounds which would not be required to carry more than 40 pounds here." This statement is undeniably true; yet, notwithstanding this fact, explosions are no more frequent here than in Great Britain, and in the latter country inspection and insurance companies are more numerous than here—some of the insurance companies having officers appointed, and paid by them to superintend the repairs of such insured boilers as may require repairs. In regard to the statement that the Lancashire, Galloway or Cornish boilers possess superior evaporating powers to the horizontal tubular, I have thus far failed to see statistics thoroughly endorsing this claim. Individual instances may have occurred where the evaporation has been greater in the English type of boiler than in the horizontal tubular, but allowance should be made for coal, setting, firing, and other contingencies which are apt to arise in all tests of this description. English authorities, as a rule, do not claim a greater efficiency, durability or economy from the use of their boilers than we can claim for ours; in fact, intelligent boiler makers and engineers who have carefully examined and closely scrutinized the workings of both types, decidedly pronounce in favor of the American work and American boiler, for economy, durability and efficiency.

I do not know whether land in the commercial centers of Great Britain is of more intrinsic value than a corresponding area in our large cities in this country, yet it is a well-known fact that here we proscribe our boiler room to a limit far below the requirements of the types of boilers so commonly used in Great Britain.

The ordinary Lancashire or Galloway boilers are made of a diameter seldom less than 7 feet, and the length varies with them (according to the quality of coal used) from 3½ to 6 diameters. While the economy of fuel in cost and consumption may be as described by "Observer" (which is not fully founded on facts), yet the interest on money required to purchase the ground, as well as the first cost of the same, must be taken into consideration in making a comparison of any value.

I lately had a consultation with a gentleman, superintendent of a large works in the central part of this State, who wished to increase his boiler capacity to 400 horse-power. On describing the different styles of the boilers to him, and giving an idea of the space required for properly setting the boilers, I was met with the remark that "our works are in a city where space is valuable, we now owning a whole square. If we decided in favor of some of these boilers we would be compelled to purchase a farm for boiler and coal houses. Our business requires our boilers on our present premises, and we have only a limited room for their introduction." This company were working the old-fashioned tubular boilers, with tubes placed close to shell, and no attention given to free circulation of water or facilities for cleaning. In the English type of boiler the increased cost over the horizontal tubular is largely owing to the difference in thickness of metal required in each, the Galloway or Lancashire, from their increased diameter requiring much heavier plate than that required in the horizontal tubular of the same horse-power. With the excessive pressure of steam usually carried in this country the tendency to collapse the internally-fired flue would be much greater than in England, and to obviate this, still heavier metal would have to be used, and as heavy metal is of necessity unprotected by the water, it would soon crystallize, and in a short time need extensive and expensive repairs. In many of the Cornish and Lancashire boilers now made in Great Britain the internal tubes or furnaces are strengthened by the use of the Adamson or Bowling hoops. The first-named is simply the flanging out of the circles at the ends, the introduction of a solid ring of flat metal between the flanges and the riveting of the three together. The ring of flat iron is used to facilitate the calking of the joint from the interior of the flue, should it leak, and these are placed at such distance as may be required to insure the greatest strength against collapse.

The Bowling hoop is simply an expansion ring —⌒— welded together, the flat parts of which connect the furnace courses, and allow for the increased expansion of the fire tube or furnace over the shell, as this brings two thicknesses of metal together, often over the fire, the Adamson is the favorite among reputable boiler builders. Some of the less scrupulous builders continue to use the ⊥ iron for connection and brace, and thus throw an increased and injurious strain on the flanged heads and gusset stays with which such boilers are usually braced. While the difference in relative cost of boiler is as stated by "Observer," namely, $700 and $1,000 for equal power, consideration must also be given to the increased cost of setting the two types. In the horizontal tubular boiler the length for 50 horse-power rarely exceeds 14 feet, and the diameter 54 inches; while the Galloway or Lancashire, from an English standpoint, requires the diameter to be 7 feet and length 30 feet for 47 horse-power. There is no real doubt as to the merits of the English boilers for evaporative efficiency, but steam users must look beyond the initial cost before deciding on the merits and economy of a boiler.

In the English types, as, in fact, in all boilers, the part exposed to the strongest action of the fire is the part usually expected to first require repairs; and to do with these, as we do in practice with the horizontal tubular boiler (remove an entire sheet), would necessitate the taking out of the front head—a job neither economical or desirable. In England this is in part obviated by the use of L angle irons instead of flanges, but in England angle irons are made especially for such purposes of first-class material; while with us angle iron never enters into our practice in boiler construction, and is not usually made of first-class material. It is also an admitted fact by English engineers that the greatest evaporative efficiency is usually observed in short boilers, and experiments have been made by them to prove the statement. If such is the case, as is admitted by them and acknowledged by us, in what way can a 30-foot boiler be found more economical than a 14-foot boiler?

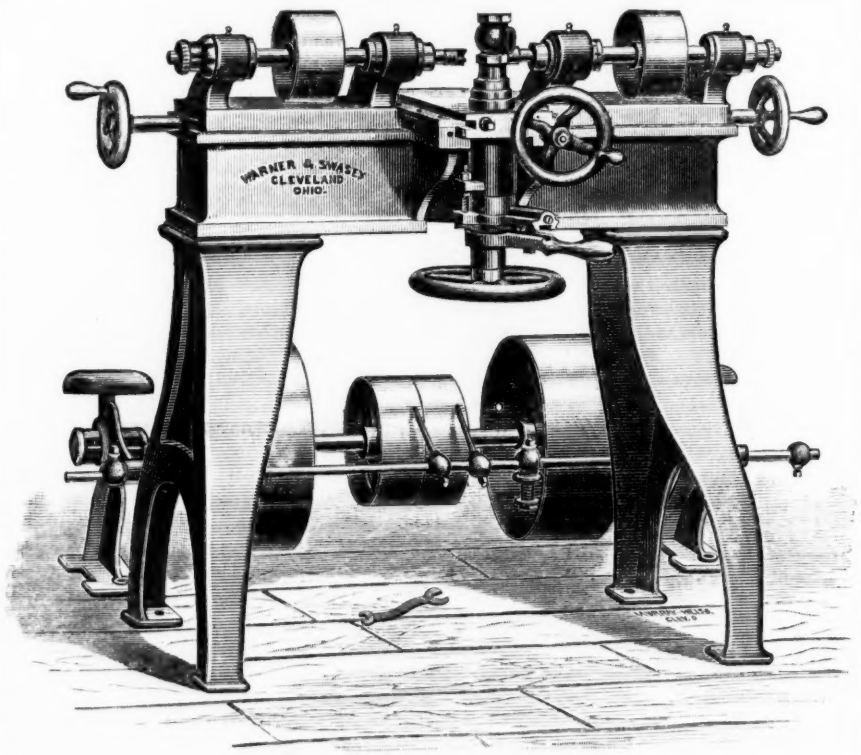
"Observer" claims for the internally-fired flue: "In this system of boilers it will be seen that the major portion of the heat is absorbed by the metal walls of the furnace and the internal heating surfaces, while the balance is returned beneath the boiler and applied to the external heating surfaces, being confined by the brick walls."

Practically considered, this statement cannot be fully accepted. While there is no doubt that much of the heat is absorbed by the brick setting of the horizontal tubular boiler, it must be borne in mind that heat is an expansive body, radiating from its center; and, while much of this heat may be lost in the brick-work, it can also be claimed that an equal quantity may pass off unutilized through the 33-inch flues usually placed as furnaces in the Galloway and Lancashire boilers. Mr. Wilson, in his treatise, says:

"If the hot gases and air passing through a tube possessed the property of imparting their diminishing heat, * * * it is probable that the heat imparted at each point in its passage would be nearly in direct proportion to the difference of temperature.

"Assuming the gas to enter at 1800°, and at each successive stage to impart one-sixth of the difference of temperature to the water at 212°, we should have a reduction in temperature in 30 feet from 1800° to 850°."

As the Lancashire and Galloway boilers are usually set with a double return of the products of combustion, the flue would, if the reduction was carried out in the same ratio, become in part a condenser before the escape of the gases into the chimney was effected, as they virtually lose 950° in their



TWO-SPINDLE VALVE MILLING MACHINE.

passage of the first 30 feet, less what they may gain by convection; but in any event the utility of the gases must be completely lost before their passage through the 90 feet. In the horizontal type, admitting the loss as already stated, the products of combustion having only to pass under shell and through the tubes a distance of 28 to 30 feet, their evaporative power must be proportionately greater than in the other case.

I do not think, even with an equal cost of fuel in England and America, that the English type of boiler will ever supersede the horizontal tubular in the hands of intelligent steam users in this country, and attention should be directed to getting a greater percentage of effective heat utilized in the present steam boiler to fully determine the relative merits of the two types, it being an admitted fact that 40 per cent. of the products of combustion are at present wasted in the atmosphere.

Lord's Combined Time Clock and Speed Indicator.

In many manufacturing interests, particularly in the textile industries, the maintenance of exact speed in machinery is of the utmost importance, too fast meaning inferior production and danger to valuable machinery, and frequently less production; and too slow less, and sometimes inferior, production. In fact, as the manufacture of anything reaches the condition of *system*, the value of exact speed becomes apparent in its effect upon both quantity and quality of product, as well as in the cost of maintaining the plant. This question of speed is one that affects not only the manufacturer, but frequently directly, and always indirectly, the operatives, since, in many instances, they are paid by the piece, and in any instance the wages that can be paid are controlled by what the machines can be made to do. Various things may affect the speed of machinery, such as improper regulation in the prime mover—engine or water-wheel—slipping of belts, poor quality of oil used, etc., etc., and any means of readily determining where the trouble is, as well as its extent, is valuable.

The machine represented with this is intended for this purpose, and from a personal examination of its operation we believe it accomplishes it in a very satisfactory manner. It consists in one of its forms, as shown at the right in the engraving, of a first-class time clock in combination with means for indicating the speed, and reading from suitably arranged dials, at a glance, the variation either way from correct speed, either in time or percentages, and per minute, hour or week. Referring to the engraving at the right (Fig. 1), the lower dial represents an ordinary clock dial, with the usual hour, minute and second hands. Arranged to be revolved about the same centers as the minute and second hands, but so as not to interfere with their motion, either by friction or otherwise, are other hands of a radically different color. These hands receive motion direct from the shaft, the speed of which is to be registered—say the crank shaft of the engine, or the water-wheel shaft—the motion being such that when the speed of the shaft is regular the time and speed hands on the second dial will keep together in their revolution, also the minute hand and corresponding speed hand. When the clock is in the engine room, motion is conveniently communicated to the speed hands by means of a small worm on the crank shaft, driving a rod through a worm wheel having the same number of teeth that the shaft should make revolutions per minute, this rod, through suitable mechanism, communicating its motion to the speed hands.

From this it will be seen that, starting with the time and speed hands together they will in their revolutions keep together, unless the speed varies from what it should be, but that if such is the case the speed hands will move faster or slower than the time hands, in direct proportion as the speed is fast or slow. In order to readily note the variation in speed the second hand dial, in addition to the circle graduated in seconds, has a second circle with 100 graduations, each of these graduations representing, of course, one per cent. This is to enable variations of speed to be read in percentages. As for instance, if the speed hand on the second hand dial loses or gains on the time hand to an extent represented by two of the 100 graduations in a revolution the shaft is running two per cent. too slow or fast, as the case may be. Of course, if desired, the variation may be read in seconds, but reading in percentages is usually more satisfactory. In making observations on the second hand dial, the speed hand can be, by means of a connection reaching outside the case, instantly set with the time hand, without changing the relative position of the hands on the hour and minute dial, or of the hands on the upper dial, to be hereafter referred to.

Upon the hour and minute dial the speed hand similarly moves with the minute hand when the speed is correct, and faster or slower when the speed varies, so that the variation can be read for any number of hours and minutes, in time, on this dial. The speed hand on this dial can also be instantly adjusted to the time hand without moving the hands on any other dial. In addition to the arrangement by which the hands on the different dials may be set separately, the arrangement is such that they may be all set together if desirable.

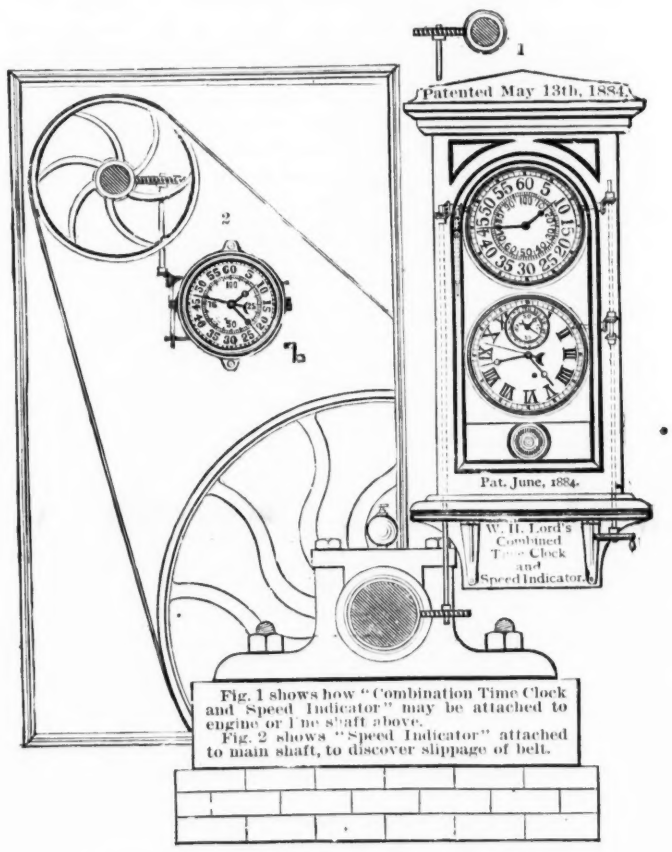


Fig. 1 shows how "Combination Time Clock and Speed Indicator" may be attached to engine or line shaft above.
Fig. 2 shows "Speed Indicator" attached to main shaft, to discover slippage of belt.

LORD'S COMBINED TIME CLOCK AND SPEED INDICATOR.

The upper dial is for speed, and is provided with two hands, one of which should revolve in 60 hours and the other in 60 minutes. This dial has two graduated circles, one graduated in minutes and hours, and the other in percentages. If the speed is not regular the small hand will indicate by the percentage it covers the exact variation. Thus, say that after a run of 60 hours the small hand covers the 95 mark of the percentage graduation, the shaft has made but 95 per cent. of the number of revolutions it should have made.

When used for determining the variation of speed of the line shaft, in any room, the speed movement may be connected to the shaft the same as to engine shaft. When the clock is located in the office it may be advisable to make electric connection with the crank shaft.

Simple means for connecting and disconnecting the speed hand mechanism are employed, so that in starting up the engine before time the speed hands may remain stationary till the exact time for starting, when the connection is made, the disconnecting also being accomplished at the exact time of stopping. In use the hands of the upper dial are adjusted once each week; those of the lower dial at noon and night.

One advantage of this clock, aside from its utility in determining fluctuation of speed and suggesting the advisability of a remedy, is in settling differences of opinions as to speed arising between superintendents and overseers and piece workmen, as a glance at the dial at once avoids all occasion for dispute. It also enables the engineer to make changes suggested by considerations of economy, because he can readily observe their effect on the speed, and correct mistakes.

In some manufactories, especially where piece work is the rule, it is customary, when it is necessary to stop the engine for a few minutes during the day, to run enough longer to make up for the time lost in stopping. As the speed hands stop with the engine the engineer is enabled to see at a glance how much longer he should run.

In one instance where this clock is in use, we were informed by the superintendent that it led to the detection of the poor quality of a new lubricating oil they were using. After using the oil a short time the speed was seen to be slow, the loss being from seven to ten minutes per day. An examination showed that by the use of the new oil the power required had been increased by about 40 horse-power. This clock is as applicable to electric light engines, marine engines, and in modified form for horse cars or other vehicles that are run on schedule time as for mill engines or water-wheels.

The arrangement shown at the left (Fig. 2), represents the speed indicator without time attachment. In this form the dial has three hands—second, minute, and hour, and a 60-hour dial. The hands are driven by worm and gear, and when the speed is regular will keep time with a watch or clock.

This is designed to be applied to line or countershafts, to detect slipping of belts and other causes of irregular motion; also to any machine to determine the time it runs and the possibilities of product.

These machines are of simple construction, easily put up and managed, and their readings can be understood by any one, without the necessity of making mathematical calculations. Their use would often show that a falling off in quantity of product, attributed to other causes, was the result of poor speed, slipping belts, and other causes easily remedied. They are made by Wm. H. Lord, 402 West 23d street, New York City.

Abilene, Texas, is called the "seaport town of the West," because so many schooners pass over her bars.

A Black Process.

Although a great improvement was made in the ferro-prussiate process for the reproduction of drawings in giving blue lines on white ground, it was never quite satisfactory. It has now been superseded by a process which, indeed, requires a lithographic press for printing off the copies, but which otherwise is effected by means of the same apparatus as the "blue" copies. This process, which is now adopted by the Belgian department of Ponts et Chaussees, affords black lines in printer's ink on a white ground. A zinc plate is coated with asphaltum, thinned with organic acids. The tracing is placed over it in a frame with glass above, as in the ferro-prussiate process, and exposed to the sun. The pitch becomes hard except where protected by the black lines of the tracing. The plate is washed, which has the effect of removing the portions still soft that have not been protected by the lines. Acid is then poured over the plate, which bites into the lines, as in ordinary etching, and the plate is polished to give sharpness to the lines. Any number of copies may then be struck off with printer's ink, as in copper plate printing. The plates may be prepared in the office and sent to a copper-plate printer for the requisite number of copies to be struck off.—*English Mechanic.*

The Ashland Emery Mills, Perth Amboy, N. J., issue a monthly trade circular. We clip the following from the June circular:

HOW TO MAKE AN EMERY WHEEL.

Take a cast-iron spoke wheel, fill it up and line with wood, secure leather bands around the periphery with wooden pegs; then cover the leather with glue, and roll in loose emery, and lay aside until dry; after which, the operation can be repeated if a thicker coating of emery is desired. When the wheel is worn, the glue can be washed off with hot water, and fresh glue, etc., be again applied.

Polishing buffs can be made of india-rubber, coated with emery, which enables an article of moderately irregular shape to be polished all over. Only the best glue will answer.

German immigration to the United States is on the increase. Something over a thousand more Germans arrived during the first quarter this year than for the same quarter last year. Bismarck is not happy, and instead of trying to make Germany more satisfactory to its own people by instituting government reforms, he vents his spleen upon the American hog. The hog can stand it if Bismarck can.

The London *Engineer* says: "There are no fewer than eighteen recognized ways of calculating the nominal horse-power of marine engines, and these vary so much in their results that while an engine with, let us say, cylinders 33 in. and 62 in. in diameter and 45 in. stroke, is rated by one rule at 149 horse-power, by another it is rated at 249 horse-power. The existence of such anomalies long since attracted the attention of Lloyd's, and Mr. Parker and Mr. Milton, the engineer surveyors to the body, were requested to report on the whole subject. This they did in 1878. The results of the inquiry were disheartening. After carefully considering the problem, they expressed the opinion that it is absolutely impossible to fix upon any rule whatever, based upon dimensions of engines or boilers, which would give a result with every variety of engine, or even with particular types of engines, at all proportional to their actual power, and they submitted for the consideration of the committee, 'seeing that the registered horse-power is so very misleading and worse than useless, and also that it does not come within the province of this society to attempt to lay down a commercial standard for marine engines, whether it would not be advisable to leave it out altogether from the register book, and only insert the sizes of cylinders, length of stroke, and working pressure of steam.'"

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NEW YORK, JULY 19, 1884.

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The Effect of Discouraging Apprenticeship.

One of the results of dispensing with apprenticeship to trades in this country is to fill our shops more and more every year with foreign-born workmen—men who are competent mechanics because they have regularly learned the trades at which they work. The idea that with special tools skilled mechanics would not be so much needed now as formerly, is not borne out by facts, and but for the circumstance that at present manufacturers here are able to secure a supply from elsewhere, manufacturing interests in this country would be in a poor way. A very pertinent inquiry is: Will they always be able to so supply themselves? We believe they will not. Various reasons are given why American boys are not more generally learning trades in this country, the most common of which is that they have not the disposition to do so, or that they are prevented by the action of trades unions. Generally there is little of truth in either of these statements. In those trades where the lack of apprentices is the most noticeable, as the machinist's for instance, so far as we know there are no trade union restrictions to the employment of apprentices, and there is no lack of American born boys anxious for opportunities to learn that trade. If trade unions do sometimes seek to restrict the number of apprentices employed it is in the very few trades in which proprietors are willing to take them to any extent, and which as a consequence, are overcrowded with applicants. The truth is, that in the machinist trade, as well as in many others, there is an unwillingness, as the expression is, "to be bothered with apprentices," and so in these trades they are every year becoming more and more the exception. The result is that American boys are driven from necessity—not from choice as is generally assumed—into occupations better suited to women than to men, or into vainly trying to get a living by virtue of an "education" more ornamental than useful, and not much of either. Working schools are trying to fill the gap opened by the disinclination to tolerate apprentices, but for various reasons they can never succeed to any appreciable extent. Not that they are not well enough so far as they go, but they would stop short of going far enough if their number was increased a thousand fold. It may not always be pleasant to be "bothered" with apprentices, but the mistake of not training up more skilled workmen is already felt in many branches of industry in this country, and if continued in will have an unfortunate if not a disastrous effect on manufacturing interests. Those countries that have the best skilled labor must beyond question lead in manufacturing, and the only sure way to depend upon having this is to train it up at home. Depending upon a foreign supply is at the best uncertain, and is prejudicial to the best interests of any community.

We have carefully scanned our numerous industrial exchanges for something of extra interest to manufacturers as a subject to write up for hot weather reading. They all admit dullness in business and lack of exhilarating news from the workshops; still occasional notes of a rush of orders in certain shops find their way into print. The magnitude and resources of Krupp's works at Essen, Germany; the wonderful big steam hammer at Le Creusot, France, and the astonishing growth of Anniston and Birmingham, Ala., furnish perennial topics for industrial literature. These are always available, and some of our contemporaries have treated them in the usual fresh and entertaining style in their most recent issues. As far as we can see, however, modern literature has not added any important fact to these subjects. With boldness (not to say rashness) some of our industrial contemporaries have taken off their coats, so to speak, and rushed into the political arena to do battle for their favorite candidate. But they are novices in that line, and cannot hold a spear against the old battle-scarred veterans of the daily press.

The latest consular reports abound in new tables of statistics of trade and commerce. They would probably make an interesting study in cool weather; but pure unadulterated statistics are apt to tire the reader if inflicted upon him during the heated term.

With many publications, the season between the meetings of the societies organized for industrial interests and the opening of the fall exhibitions might be called "between hay and grass."

Protecting the Property of Employers.

A few weeks ago a union meeting of the Brotherhood of Locomotive Firemen was held in Denver. The following preamble and resolution was unanimously adopted:

Recognizing the identity of the interests of capital and labor, and feeling that much good can be done by the establishing of this fact to a still closer and better understanding, to the end that the present harmony and good feeling existing with the members of our Order may not only continue, but extend to other and all branches of industry, therefore be it

Resolved, That we earnestly urge upon all Lodges the importance of teaching to members the justness and honesty of protecting the property of their employers with the same interest displayed in guarding that which belongs to themselves, believing that securing the welfare of the business from which we derive our livelihood is certainly advancing our own.

The above principle can and should be applied just as well to other industrial interests as to railroading. If a man will not carefully manipulate and preserve the property of others intrusted to his charge, the chances are very much against his ever having any property of his own, to speak of, unless he inherits it. True it is that a great many workmen never look at the matter in this light, but the promotions are made from among those that do. In railroad business there are a number of different grades, all being filled by employes of the company. The upper grades are filled as a rule by men who have been faithful to their trusts when occupying positions in the lower grades. A railroad could not be successfully managed without the employes in responsible places exercising the same care to preserve the company's property as they would if it were their own. In ordinary industrial establishments there are fewer grades for employes to fill, and sometimes too little sense of responsibility by those who are in the lowest grade and seem contented to stay there without any effort to get a peg higher. It is worth while for employes of every grade to give these matters careful consideration.

Any school of political economy which declares countries over-populated when millions of acres of land susceptive of cultivation are abandoned to sterility; that will accuse industry of the sin of over-production when millions of men, women, and children are hungry for every necessary of life, and which declares money redundant when millions of pockets are penniless, is a monstrosity too damnable to be tolerated among civilized men.—*Iowa Tribune.*

The above thrust is evidently aimed at the free trade school of political economy, which teaches that our protective tariff has stimulated too much industry, causing an "overproduction" and a consequent stoppage of many industrial establishments. It's a queer theory of political economy when followed to its logical conclusions.

On another page we present a letter from Wm. Fraser Smith, President of the Railroad Employes' Library Association of Carlin, Nev., giving some particulars about the organization and maintenance of that library. We recently had the pleasure of a call from Mr. Smith, who is Division Master Mechanic of the road. He is enthusiastic over the success of the library, and has given not only much effort but liberally of his private means to push forward the enterprise. There can be no doubt of the great advantage to railroad employes in having access to such a library as the catalogue shows this to be. The books have been selected to interest and instruct, recognizing that the former must always precede the latter. We should like to see libraries of this kind established on every railroad. In a future issue we shall publish the most essential provisions of the constitution and by-laws of the Carlin library.

Opportunity to Sell Goods in Mexico.

A great deal has been written about the new treaty with Mexico, and the important effect it is likely to have upon our manufacturers. The treaty has been fully ratified, and as soon as provision is made by Congress to carry it into effect the results will begin to show for themselves. In addition to water communication with Mexico, there is now a railroad in operation from El Paso, Texas, to the City of Mexico. At El Paso it connects in three different directions with the railroad systems of the United States. Transportation is, therefore, favorable to trade. We have before us the full text of the treaty. The following articles appear to be the most important: admitted free of duty into the United States: Raw hides, except sheep skins with wool on; india-rubber, crude; dye stuffs; quicksilver; sugar; tobacco in leaf; wood and timber. The list of goods to be admitted free into Mexico is somewhat lengthy. Those likely to be of most interest to our manufacturers are: Anvils; railway cars and road wagons; fire pumps and fire engines; iron and steel rails; locomotives; machines and apparatus of all kinds for industrial and agricultural and mining purposes, sciences and arts, and any separate extra parts and pieces pertaining thereto; patterns for the arts; tools and instruments of steel, iron, brass or wood, or composed of those materials, for artisans.

Our manufacturers of machinery and tools ought to send agents to Mexico to see what is in demand and take some orders.

As business is not very active just now, the orders could be promptly filled. Very little information can be obtained about the demand without going or sending there to find out.

Industrial Exhibitions.

The industrial exhibitions this year promise well. We are to have everything, from a world's fair to a county agricultural show. There are to be eight or ten industrial exhibitions of note, the greatest of which will be the World's Industrial and Cotton Centennial Exhibition at New Orleans, beginning the first Monday in December and running until the 31st of May, 1885. Then there is to be an International Electrical Exhibition, under the auspices of the Franklin Institute, in Philadelphia, from September 2d to October 11th. The Southern Exposition, at Louisville, Ky., opens August 16th and closes October 25th. The Cincinnati Industrial Exhibition opens September 3d, and closes October 4th. The Massachusetts Charitable Mechanic Association will open their exhibition in Boston some time in September, and let it continue ten weeks. The New England Manufacturers and Mechanics' Institute will hold an exhibition in Boston from September 3d to November 1st. The Mechanics' Institute, of San Francisco, will hold its annual exposition from August 5th to September 6th. The St. Louis Exposition opens September 3d, and closes October 18th. The Colorado Industrial Exhibition, at Denver, opens about September 1st. The American Institute Fair, in this city, will probably be held as usual, but we have seen no announcement of the time of opening.

Senator Blair, from the Committee on Education and Labor, reported June 29th to the Senate favorably, and without amendment, the bill recently passed by the House of Representatives to prohibit the importation and migration of foreigners and aliens under contract or agreement to perform labor in the United States. The report says that although there are certain features of the bill which might well be changed or modified, it is reported without amendment in order that it may not fail of passage during the present session.

As we have said before, if a majority of the Senate is in favor of the passage of a bill

of this kind, it will become a law at this session of Congress, and the vexed question of importing foreign cheap laborers, under contract, to reduce the wages of American workmen will be effectually settled.

Literary Notes.

TESTING MACHINES, THEIR HISTORY CONstruction and Use. By Arthur V. Abbott. D. Van Nostrand, publisher, 23 Murray and 27 Warren streets, New York. Price 50 cents.

The author has been employed for several years in the work of testing the strength of materials, and in this work gives an outline of such of his methods as seem to him more generally applicable. The work is illustrated with cuts of several testing machines, and contains instructions for using the testing machine, with tables showing the effect of processes of manufacture and construction. In the present state of interest in the strength and behavior of constructive material, this book will be found of especial interest.

THE MATERIALS OF ENGINEERING. In Three Parts. Part III. Non-Ferrous Metals and Alloys, Copper, Tin, Zinc, etc.; Brass, Bronze, etc. By Robert H. Thurston, A. M., C. E. New York: John Wiley & Sons, 15 Astor Place.

This volume concludes Prof. Thurston's work on the subject named, and one of the most valuable of recent works on engineering topics. Part III. contains a history of metals and their alloys, and a large amount of information on the reduction of ores, manufacture of metals and alloys, their strength and other qualities that affect their usefulness in the arts, the effect of various stresses, their mechanical treatment, uses to which they are put and the various conditions that affect them in use, manner of testing, with tabulated results, proportioning of parts made from various materials, furnace manipulations, etc., etc. Altogether, the volume before us contains information not readily obtainable elsewhere, and of direct practicable value, not only to the engineer, but to the manufacturer and worker in metals and alloys. As each of the three volumes is complete in itself, this part—perhaps, in a general sense, the more valuable of the three—can be made use of by those especially interested in the subjects it treats without reference to the preceding numbers.

THE MODERN HIGH EXPLOSIVES. Nitro-Glycerine and Dynamite: Their Manufacture, their Use, and their Application to Mining and Military Engineering; Pyroxyline, or Gun Cotton, the Fulminates, Picrates, and Chlorates. Also the Chemistry and Analysis of the Elementary Bodies which enter into the manufacture of the principal Nitro Compounds. By Manuel Eissler, Mining Engineer. New York: John Wiley & Sons, 15 Astor Place.

This volume is, for convenience, divided into three parts. In part first the author takes up the chemistry and analysis of the bodies entering into the manufacture of explosives, and details the process of manufacture. In part second he gives directions for their use, including preparation of charges, manner of firing, etc. Part three treats of the principles of blasting, the force and effect of explosives, with manner of determining the proper charge, and methods of charging, in the different purposes for which such explosives are used. An appendix treats the preservation of nitro-glycerine compounds, and various questions relating to this and other explosives. Considering how little is really known of this class of explosives, the information given in this book will be found valuable as inducing greater safety both in their manufacture and use.

COTTAGES, OR HINTS ON ECONOMICAL BUILDing, containing twenty-four plates of medium and low-cost Houses, contributed by different New York architects. Together with descriptive letter-press, giving practical suggestions for Cottage Building. Compiled and edited by A. W. Bruner, architect. To which is added a chapter on the Water Supply, Drainage, Sewerage, Heating, and Ventilation, and other Sanitary questions relating to Country Houses, by William Paul Gerhard, C. E. New York: William T. Comstock, 6 Astor Place. Price, post-paid, $1.

This is a book on a common-sense subject, written in a lively, plain, practical style, and readable from beginning to end. Those who contemplate building a house will gain valuable information from its perusal, and those who own a house will find hints that can hardly fail to be worth several times the cost of the book to them, particularly in the chapter relating to sanitary questions.

The *Slate Trade Journal* is a new monthly published at Easton, Pa. The first number is well made up. The introductory promises that: "Its columns will contain information interesting to all who are engaged in the production, manufacture, and consumption of slate; such as the news of all the slate districts in the United States; the state of the market; the character and quantity of the output; statistics; popular articles on the geology of the slate regions, methods of mining and manufacture, and the various kinds and uses of slate; and the history of the trade in general, and the different quarries in particular."

The Clay Worker is a new trade journal, published monthly by Frank W. Patton & Co., Indianapolis, at $1 a year.

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

Every question, to insure any attention, must in variably be accompanied by the writer's name and address. If so requested, neither name, correct initials, nor location will be published.

(273) J. F. D., Cleveland, O., who asks about the blue process of copying drawings, will find instruction in the AMERICAN MACHINIST of October 8, 1881.

(274) G. W. B., Minneapolis, Minn., asks: 1. What is the highest pressure allowed by Government on any kind of a steam boiler? *A.*—The pressure allowed is in accordance with the strength of the boiler, and is practically unlimited. 2. What is the best book on bronzing? *A.*—We do not know of any book on this subject.

(275) S. W. H., Warren, Mass., asks: Will two steam cylinders of equal diameter and stroke, and under the same conditions, give *exactly* the same power? *A.*—The fact that if all other conditions were exactly alike, the power would be the same, cannot be questioned. When it comes to splitting hairs, however, it is impossible to make all conditions alike. It is done every day, near enough for all practical purposes.

(276) Mona, Worcester, Mass., asks: Assume a tank to be one hundred feet above a pump Will it require more power to pump water into it if the pipe is carried up and over the top of the tank than if it enters the bottom? *A.*—It is a question of the height to which the water must be forced, and since, generally speaking, the water must be forced a little higher with the pipe entering at top of tank, more power will be required.

(277) R. S., Petersburg, Va., writes: I wish to hold a pressure of 1,200,000 lbs. per sq in, with a safety valve 5-16″ diameter, using a lever 18″ long, length of fulcrum 1½″. What would be the weight of ball? *A.*—You do not state all that is necessary to be known. See Questions and Answers in AM. MACHINIST of May 8, 1880. Perhaps it will answer your purposes to know that the weight of ball required will be something like twelve tons.

(278) D. D., Stamford, Conn., asks: Assuming that we have a machinery-manufacturing establishment—smith shops, foundry, and machine shop—doing mostly small machine work, but some moderately heavy work, what percentage of the total power required would be required to run the main and countershafts, say just at the time power is thrown off at night or noon; shafting to be of the best quality, well taken care of, and belt connections fairly direct. *A.*—We should say, under the circumstances named, a fair estimate would be from ten to fifteen per cent. It will depend, however, upon the arrangements, and may be twice that. This does not include the friction of engine.

(279) A. F. W., Providence, R. I., asks: 1. I am told that a Corliss engine will not cut-off later than one-half stroke. If this is so, why is it? *A.*—The valve must be tripped, or unhooked, during its forward movement, and as it must be capable of making both a forward and backward movement, by which the port would be opened and closed during the stroke of the engine, it follows that the forward movement cannot occupy more than half the stroke of the engine. 2. In figuring the water consumption from the indicator diagram, should the terminal pressure be measured from vacuum in both condensing and non-condensing engines? *A.*—Yes. 3. What is a good proportion of length of connecting rod to stroke? *A.*—Connecting rod from 2½ to 3 times the stroke. A very common proportion for stationary engines is connecting rod 2¾ times the stroke.

Business Specials.

Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Mackenzie Cupolas and Blowers, 245 Broadway, N.Y.

SHAFTING STRAIGHTENERS—J. H. Wells, Tampa, Fla.

Presses & Dies, Ferracute Mach. Co., Bridgeton, N. J.

Steel Name Stamps, &c J. B. Roney, Lynn, Mass.

Interchangeable work a specialty. Send stamp for new Lathe Catalogue. E. O. Chase, Newark, N. J.

"How to Keep Boilers Clean." A book mailed free, by James E. Hotchkiss, 86 John street, N. Y.

Fine tools and special machinery. Horace Thurston, 84 Clifford street, Providence, R. I.

Herbert W. T. Jenner, Mechanical Engineer and Solicitor of Patents, 632 F st., Washington, D. C.

Lyman's Gear Chart. How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn.

Foot Power Machinery, for workshop use, sent on trial if desired. W.F. & John Barnes, Rockford, Ill.

The latest Improved Tack and Match Machinery is made by White Machine Co., Waterbury, Conn.

Pattern and Brand Letters. Vanderburgh, Wells & Co., corner Fulton and Dutch streets, New York.

Universal grinders for lathe-centers, chucks, angles, or cylinders. C. C. Hill, 84 Market st., Chicago, Ill

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

National and box chucks, foot and power lathes, and slide rests. Lodge, Barker & Co., Cincinnati, O.

DRAWINGS—Mechanical, electrical and Patent Office. All styles of artistic designing. Special facilities. Low rates. Wallace Metcalf, 140 Nassau St., N.Y.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

Improved Tack Machinery, made by The Willets Man'f'g Co., can be seen in operation at their works, 57 Clifford St., Providence, R. I.

The "Wax Process" Engravings shown in the AMERICAN MACHINIST each week are made by Struthers, Servoss & Co., 32 Frankfort Street, N. Y.

Difficult machines invented and built; coarse screws cut. V rotary files for fine milling, by mail 50 cts. Tower Machine Works, E. Brookfield, Mass.

Engine Lathes, Hand Lathes, and other fine tools. Assortment large: prices low. Frasse & Co., 62 Chatham St., N. Y.

The Complete Practical Machinist, $2 50; the Pattern Maker's Assistant, $2.50; Mechanical Drawing Self-taught, $4 00; books for practical machinists. Address, Joshua Rose, Box 3,306, New York City.

EXTRACTS FROM CHORDAL'S LETTERS, 400 pages, 12mo., handsomely bound in cloth. New and enlarged edition, with over 50 illustrations. Price $2. Published by John Wiley & Sons, 15 Astor place, New York.

For a strictly first-class automatic engine, from 10 to 60-horse power, apply to the Straight-Line Engine Company, Syracuse, N. Y.; medium or high-speed; perfect balance; fewest parts and fewest working joints; uniform speed at all ranges of power or steam pressure; the best material and workmanship in all vital parts; the most correct distribution of iron; unexcelled in smooth running.

Manufactures.

The Roanoke (Va.) Machine Works are going to build locomotives.

Whitman, Rost & Co., St. Louis, will erect a two-story brick factory.

Citizens of Hubbard, O., are offering inducements to industrial establishments to locate there.

P. Kaufman, 21 N. Green street, Chicago, will erect a three-story factory at a cost of $8,000.

Dinguid & Son, of Roanoke, Va., will at once erect a foundry at New River, Pulaski county, Va.

A. Beaton will erect a felt manufactory at 187 West Larned street, Detroit, at a cost of $8,000.

The Ohio Valley Foundry Company, Bellaire, has been incorporated, with a capital stock of $30,000

Settle Brothers, 96 Green avenue, Brooklyn, N. Y., will erect a three-story leather factory, 40x100 feet.

The Johnson City Foundry and Machine Company has been organized recently at Chattanooga, Tenn.

Ex-Governor, Talbot, of Mass, and other capitalists, are to build and operate a large flannel mill at Ayer.

A factory, 30x100 feet, two stories high, is building at Bellaire, O., and its principal product will be scoops.

The Jennings-Griffin Hardware Co., of Yalesville, Conn., are putting up a forty-foot addition to their main shop.

Sargent & Co., New Haven, Conn., will in a short time add a number of new boilers to their extensive steam plant.

The Beaumont Iron Works, of Beaumont, Texas, Crichton & McIntyre, proprietors, lately burned, are being rebuilt.

The Putnam (Conn.) Foundry and Machine Company will erect a foundry 50x100 feet and a machine shop 30x100 feet.

The Cookson Iron Works Company, Kansas City, Mo., are making a new milling machine of their own design for their special use.

The foundry and machine works of Stedman & Baines, at Helena, Montana, are enlarging, by building a stone addition 40x90 feet.

It is stated that $20,000 worth of first-mortgage bonds, the entire issue, have been taken for the new nail works at Lewisburg, Pa.

D. R. Locke (otherwise known as Petroleum V. Nasby), Toledo, O., has a building permit to erect an iron foundry at a cost of about $2,000.

The Hoyt Brothers Manufacturing Company, Aurora, Ill., having completed the new addition to their machine shop, will now extend their foundry about seventy feet.

Cedar Rapids, Ia., is to have plow works. The sum of $78,000 has been subscribed to the stock of the company, and it is expected to close the subscription list in a few days.

The works of the Hartford (Conn.) Engineering Company were closed Monday, June 16, for the final settlement of the affairs of the company, by order of Mr. E. M. Bunce, the receiver.

Joseph Boyer, St. Louis, has completed a 24x30-foot three-story addition to his machine shop, in which will be placed most of his machinery for the manufacture of autographic registers.

Mr. F. E. Richenberg has broken ground at the corner of Ann and West Randolph streets, Chicago, for his new furniture factory, which is to be four stories in height and 49x92 feet in area.

The Tennessee Iron Manufacturing Company—stock $1,000,000—has been organized at Columbia, Tenn, by Robert M. McKay, William J. Whitthorne, F. J. Ewing, George Childress, and others.

Nichols & Langworthy, of Hope Valley, R. I., recently shipped twenty engines from their works, and a high-speed engine to C. B. Cottrell & Sons, of Westerly, to be used in their new foundry.

The Pittsburgh Bessemer Steel Company is erecting a mill for the manufacture of structural steel for buildings and machinery. The foundation of the building is being laid, and the whole will cost $80,000.

A woolen mill to cost $30,000 is being erected at Riverside Springs, near Colorado, Texas. The Colorado (Texas) Oil Company has also been organized, with a capital of $50,000, to erect a cotton-seed oil mill at that place.

The mills of the Indian Head Corporation, at Nashua, N. H., are running to their present capacity, making a coarse shirting, which it ships direct to China. The mills of the upper corporation are running five days per week and housing their goods.

S. W. Card & Co., Mansfield, Mass., have issued a forty-page illustrated catalogue and price-list of taps (all varieties) solid bolt dies, reamers, tap wrenches, screw plates, etc., manufactured at their works. It is very neatly arranged and finely printed.

June 20th the Connellsville Coke Producers' Association decided, in view of the unsatisfactory condition of trade, to further restrict production by closing down 10 per cent. of the ovens. This will reduce production 25 per cent. It was decided to make no change in the selling price.

The Waltham Watch Company has notified its employes that until further notice their factory will be closed on Mondays and Saturdays of each week. Depression in the watch business is given as the cause. All employes are required to take two weeks' vacation in August.

Waddington & McConway, Sharon, Pa., purchased the Keystone Foundry June 1, and have made some extensive improvements. Tools have been put in for carrying on a general machine business. A building is now being erected for a blacksmith shop, and a new machine shop will soon be built.

The shops of the Columbus, Hocking Valley, and Toledo Railroad, at Columbus, O., closed July 1, throwing three hundred men out of employment. This measure was taken because of the strike of the coal miners. The road is left without business. It has had four thousand idle cars for over six months, and has double that number now.

The St. Louis *Age of Steel* says: Business at machine shops is very quiet, and the larger establishments especially are working greatly reduced forces. Boiler works are less actively employed than heretofore, but considering the times have a fair amount of work to do. Of the six stove works four are shut down, and one of the two running is only taking off three heats a week. Hardware works are rather poorly employed.

Madison, Ind., has raised $100,000, and Mr. O. M. Harper, of Pittsburgh, proposes to locate the Eagle and Banner Cotton Mills, of Pittsburgh, in that city. The plant will consist of over thirteen thousand spindles, and will require a building one hundred by two hundred feet, three stories high and a basement, with an engine of four hundred-horse power, and will employ five hundred hands. Capital stock required, $250,000. Mr. Harper is to put in $100,000 in machinery, and $20,000 in cash, and is to take charge and run the mill.

C. A. Sawyer, of Fitchburg, Mass., has invented and patented a jet water motor which has improvements over those in use. The wheel can be changed to run either way in the case, the water being introduced from either side of the case. The buckets on the wheels are of brass, do not rust, and will last for years. The motor is used by Merriam & Rolph, who have a fifteen-inch motor for raising grain from the basement to the loft of their storehouse. The grain is unloaded from the cars and passes through a spout into the basement. The motor runs an endless belt upon which are cups, which pass upward through the lower end of the spout and carry the grain to the cupola of the building, from which it descends by gravity through spouts to the bins, where it is stored. The motor raises to the height of thirty-one feet about two hundred bushels of grain per hour. A stream of water one-fourth of an inch in diameter runs the motor.—*Boston Commercial Bulletin.*

Machinists' Supplies and Iron.

NEW YORK, July 3, 1884.

The condition of the supply business remains substantially unchanged, which is equally true of manufacturing interests.

American iron is handled only in small lots, sufficient for immediate requirements, and prices remain stationary. We quote No. 1 X Foundry, $20 to $20.50; No. 2 X $18.50 to $19.50; Grey Forge, at furnace, $16.50 to $17.50.

Antimony is quoted at—Hallett's, 10⅝c.; Cookson's, 11c.

Copper is dull, with small sales of—Lake, 14c. to 14⅛c.; other brands, 13c. to 13¼c.

Lead has sold in small lots, at 3.60c. to 3.62.

Spelter—Refined, 8c. to 8¼c.

Tin sells slow at—Banca, 20¾c.; Straits and Malacca, 18⅞c. to 19c.

✲WANTED✲

"Situation and Help" Advertisements, 30 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Wanted—Machine shop foreman used to first-class engine work. None except those who can give the best of references need apply. Address M. D. Leggett & Co., Cleveland, O.

Boiler-shop foreman, with twelve years' experience on stationary, marine, and locomotive work, would like situation in similar capacity. Address "Vulcan," care of AM. MACHINIST.

Wanted—Situation as foreman moulder; accustomed to all classes of work, loam, dry sand, green sand, core making, mixing and melting metal. Twenty-six years' experience. Address "Foreman," BOX 2, AM. MACHINIST.

Wanted—Parties traveling and selling to steam users, or dealing in mill supplies, to take the agency of a good and fast-selling article. Good inducements offered. Address "Manufacturer," care of AM. MACHINIST.

A first-class New York house, manufacturing improved sugar machinery, etc., desire a Chicago connection, for the sale of their goods on commission. With a good, reliable house, willing to push sales, a liberal arrangement would be made. Address S. S. & Co., office of AM. MACHINIST, New York.

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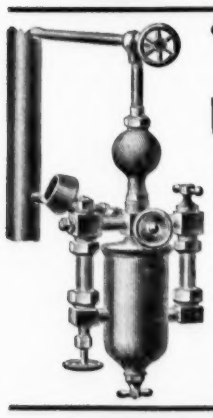
BEVEL GEARS,
Cut Theoretically Correct.
For particulars and estimates apply to
BREHMER BROS.,
Machinists,
440 N. 12th St., Philadelphia, Pa.



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INVOLVING A
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The most perfect Lubricator in Use.
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ENGINES and BOILERS,
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Send for Special Catalogues.
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FOR HARD COAL OR COKE.
INDISPENSABLE IN ALL SHOPS to keep **Bradley's Cushioned Hammers** and men fully employed, and reduce cost of production.
BRADLEY & CO., Syracuse, N. Y.
(ESTABLISHED 1832.)

IRON AND STEEL
DROP FORGING.
Of Every Description, at Reasonable Prices.
R. A. BELDEN & CO., DANBURY, CT.

NEW No. 224 MILL STREET.

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can have the best accommodations to work out new machines at
Wing's Pattern and Machine Works, Greenfield, Mass.
New Shop, New Tools and First-class Workmen.

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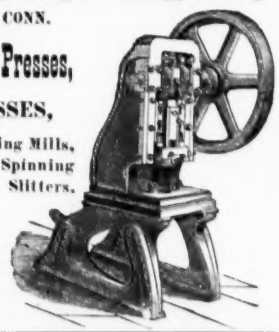
WATERBURY, CONN.
Patent Power Presses,
DROP PRESSES,
Foot Presses, Rolling Mills, Rivet Machines, Spinning Machines, Gang Slitters,
Special Machinery
for Sheet Metal, Wire, Etc.



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STANDARD SIZES ON HAND OR QUICK DELIVERY.
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PUMPING MACHINERY.

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FOR ALL DUTIES.
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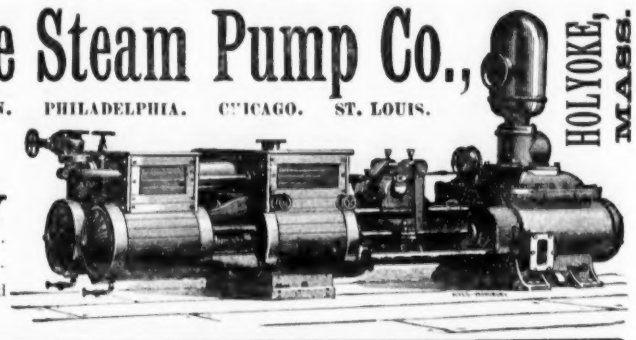

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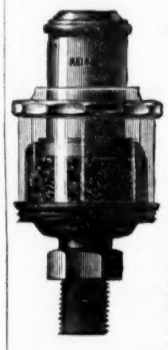

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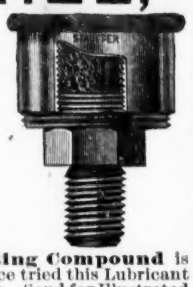

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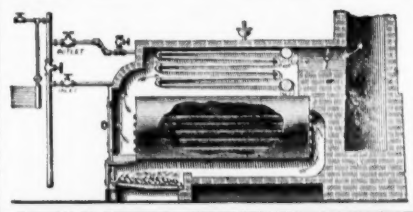

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No. 18 Broadway, New York.

TABLES OF SPEEDS.

Tables of the principal speeds occurring in mechanical engineering, expressed in mètres in a second. By P. Kecrayeff. Translated by Sergius Kern. Price, 20 cents. Descriptive catalogue of books, 100 pages, free.

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MACHINIST TOOLS

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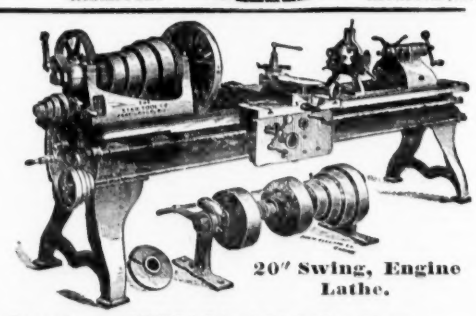

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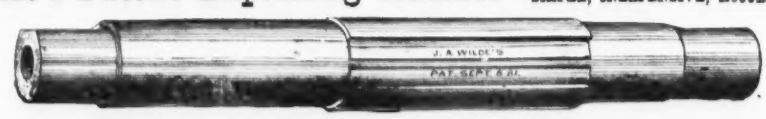

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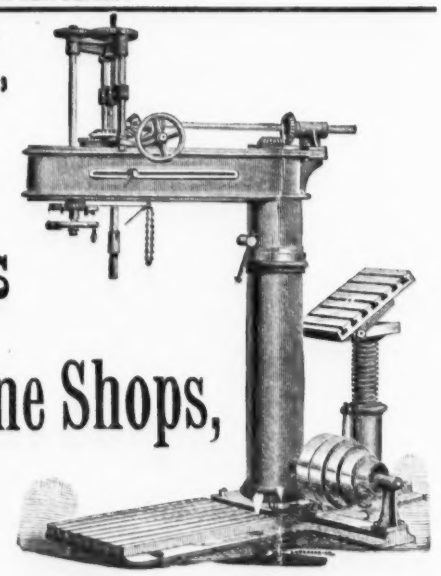

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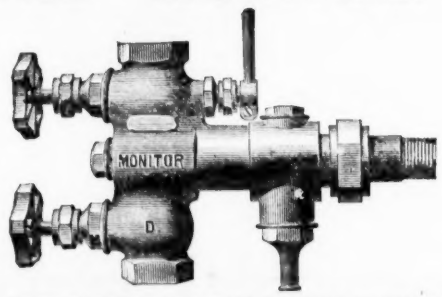

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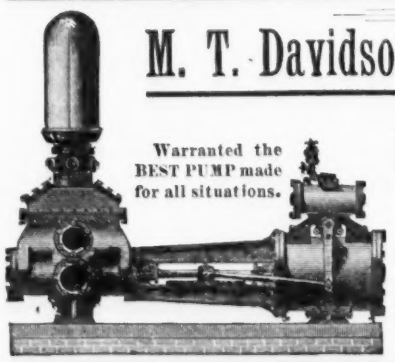

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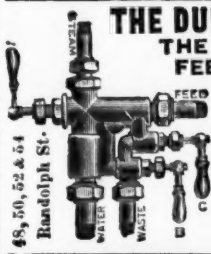

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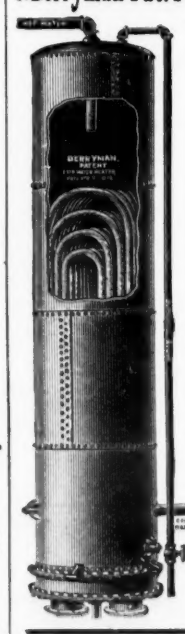

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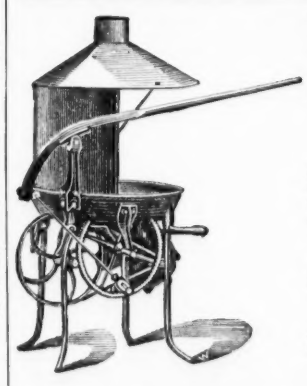

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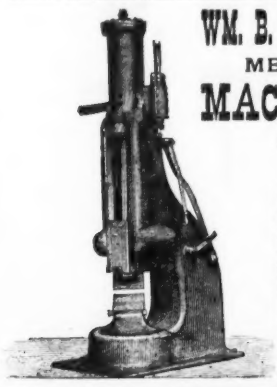

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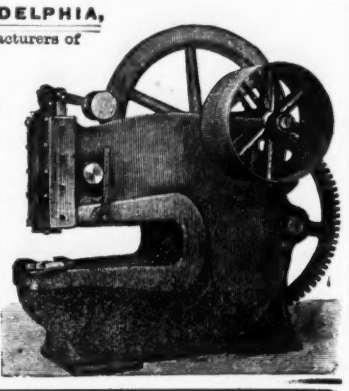

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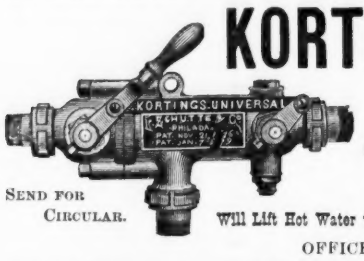

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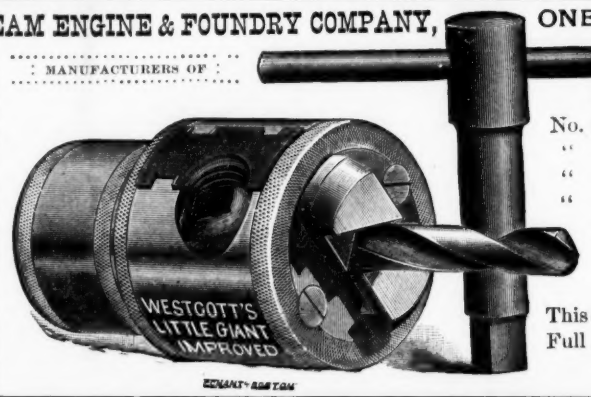

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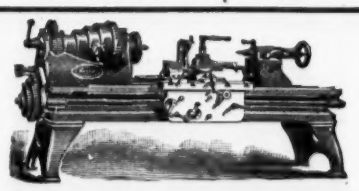

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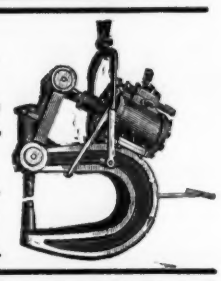

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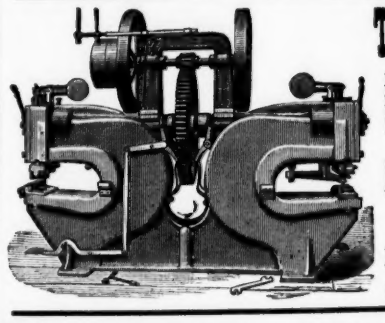

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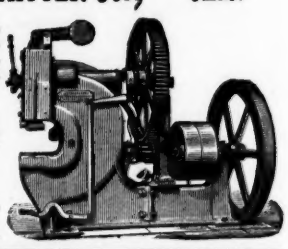

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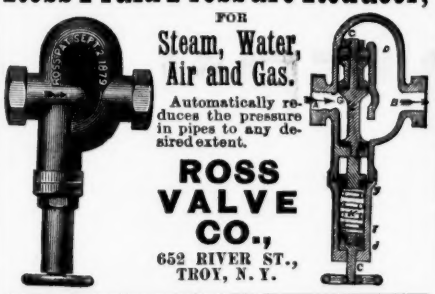

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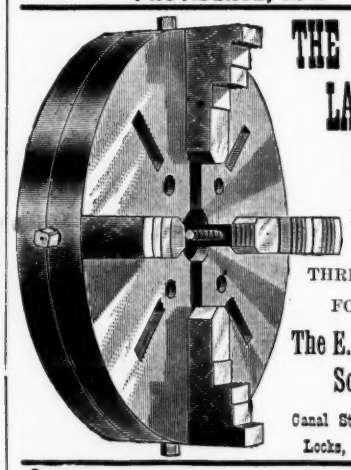

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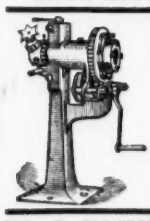

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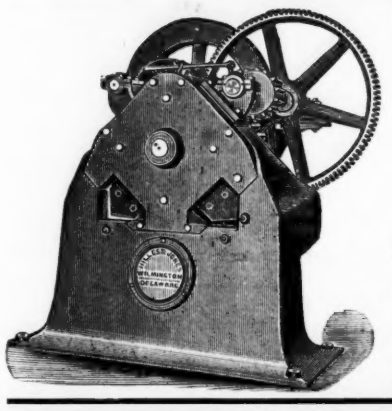

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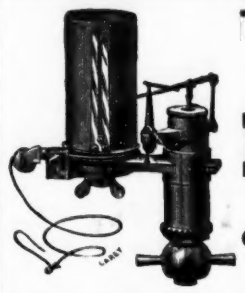

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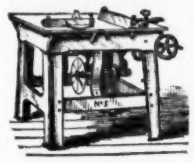

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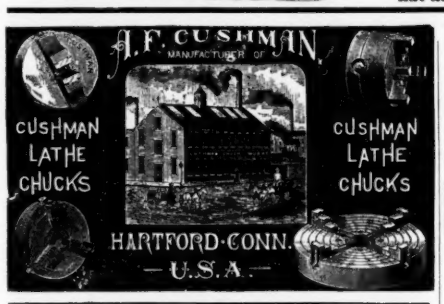

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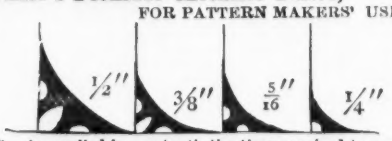

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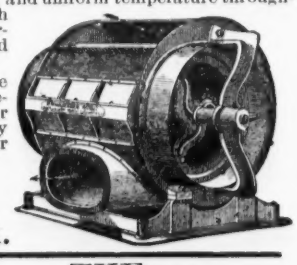

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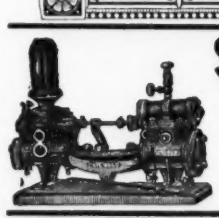

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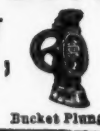

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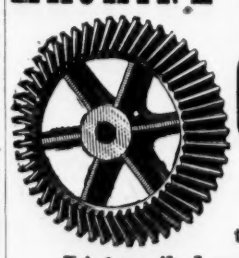

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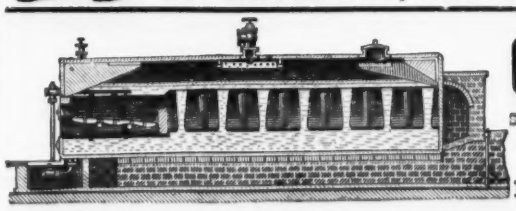

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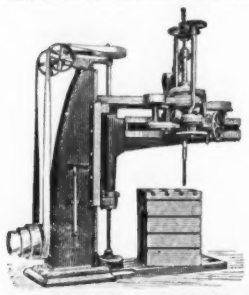

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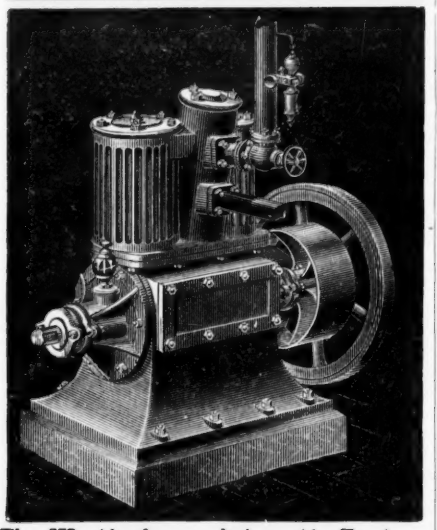

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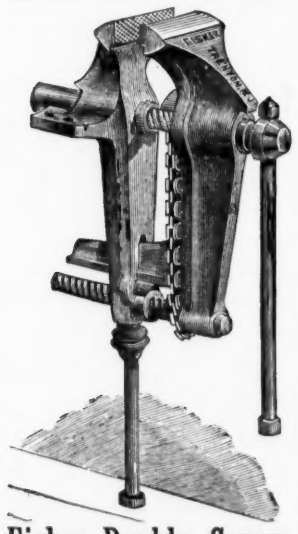

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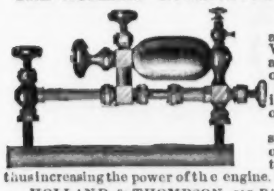

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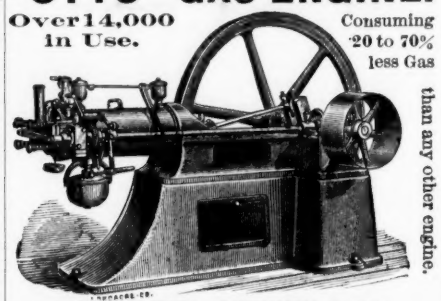

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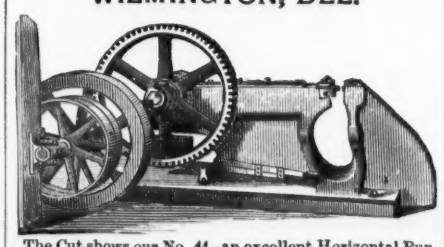

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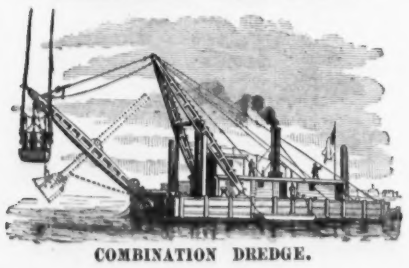

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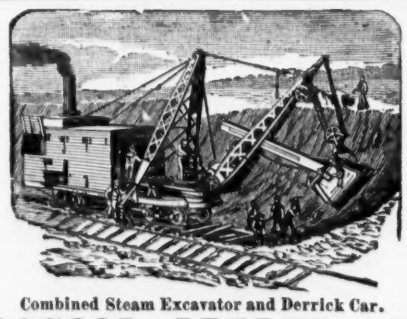

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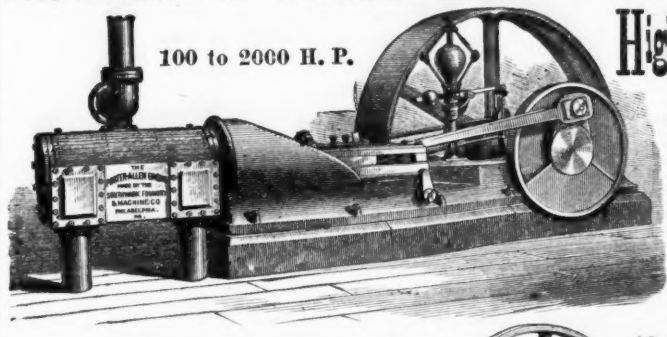

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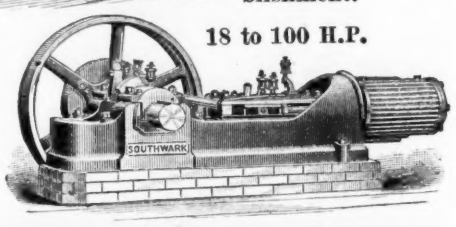
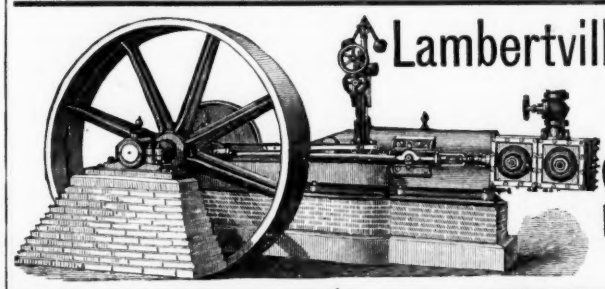


18 to 100 H.P.



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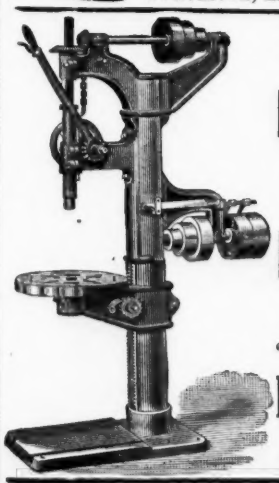

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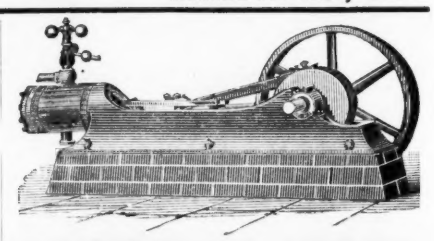

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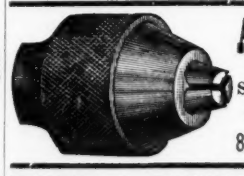

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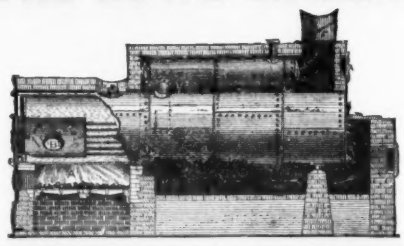

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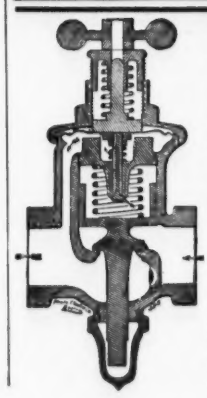

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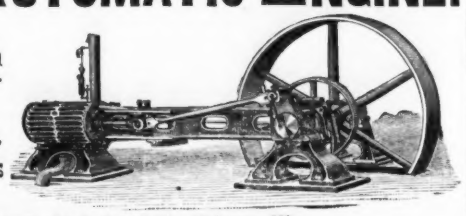

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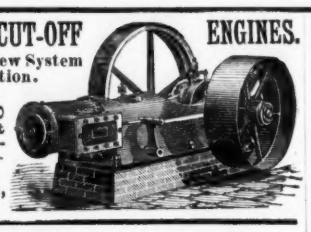

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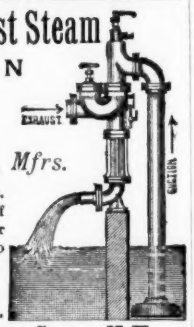

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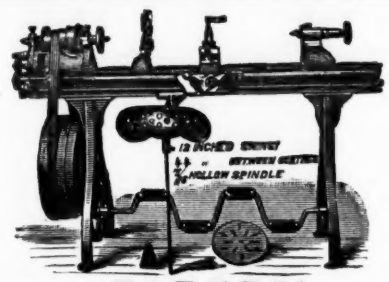

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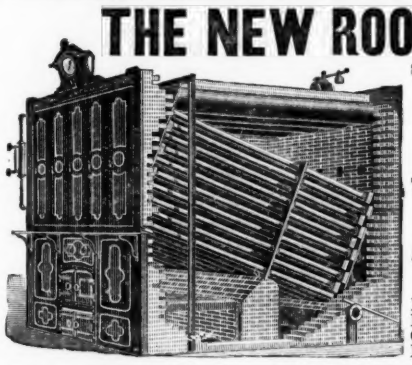

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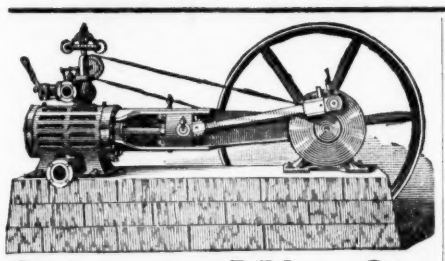

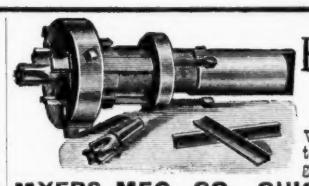

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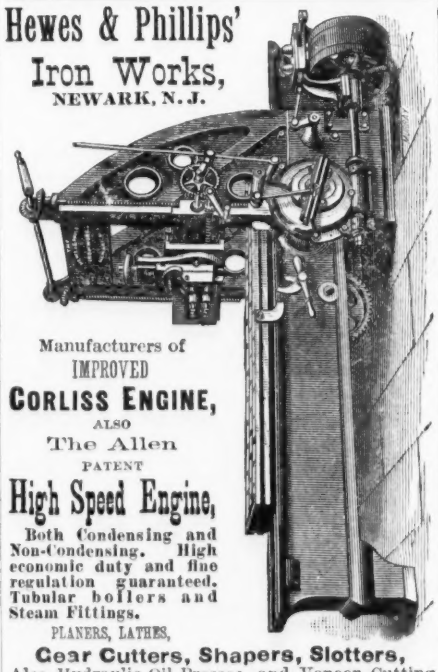

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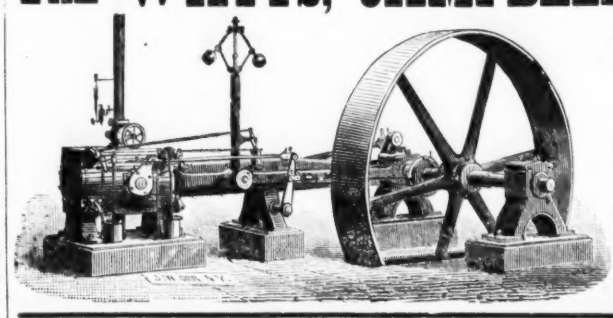

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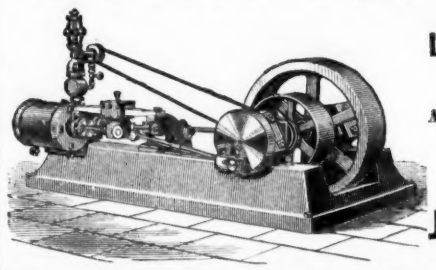

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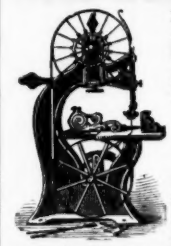

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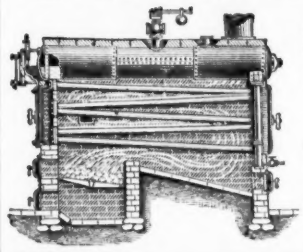

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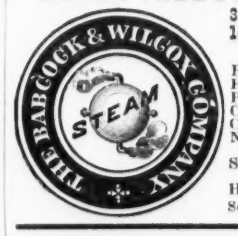

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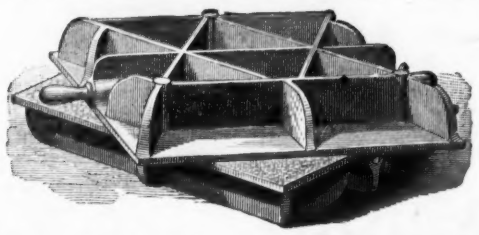

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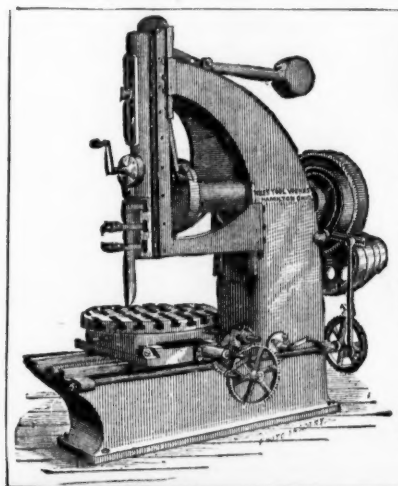

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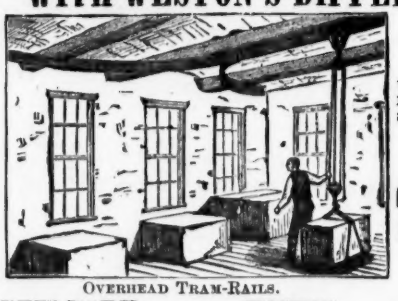

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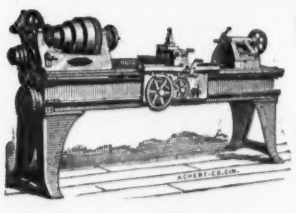

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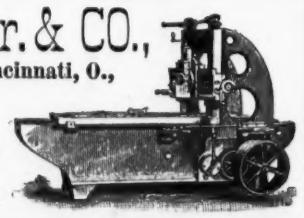

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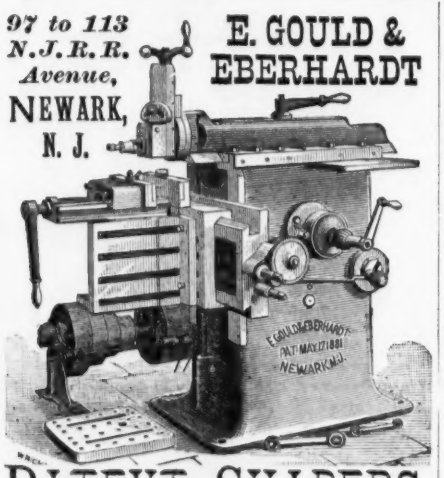

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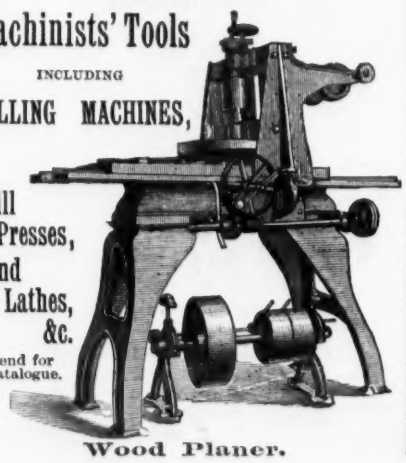

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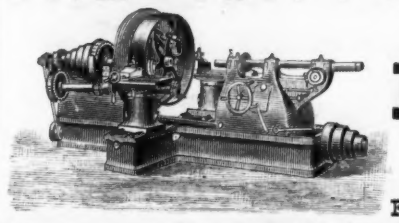

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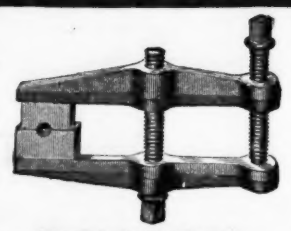

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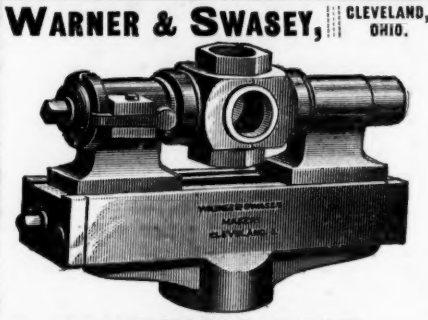

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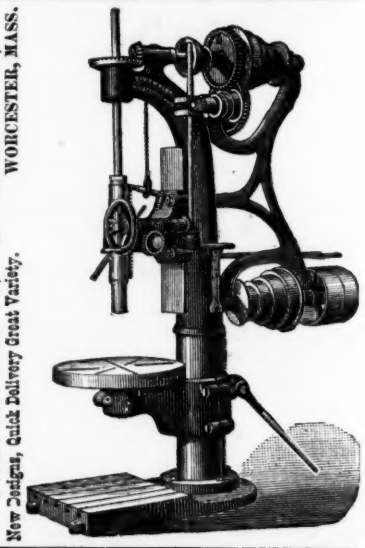

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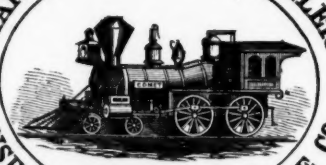

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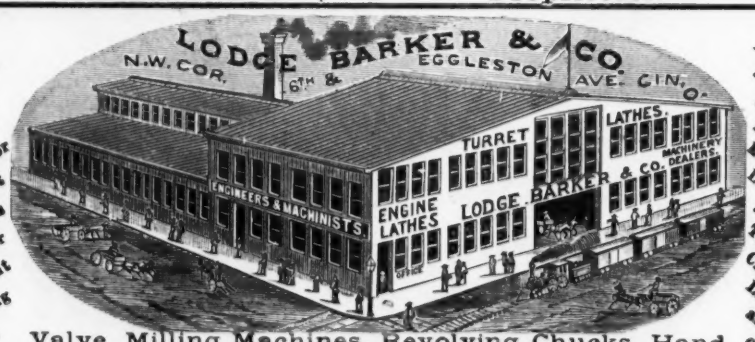
PRATT & LETCHWORTH, Proprietors.

14 in. and 16 in. Monitor Turret Lathes with or without Chasing Bars.



18 in., 24 in. and 26 in. Engine Lathes and Turret Chuck'g Lathes always on hand

Valve Milling Machines, Revolving Chucks, Hand Speed Lathes with dove tail set over, and a full line of Brass Finishers' Machinery.

J. M. CARPENTER PAWTUCKET, R. I.

MANUFACTURER OF TAPS & DIES.